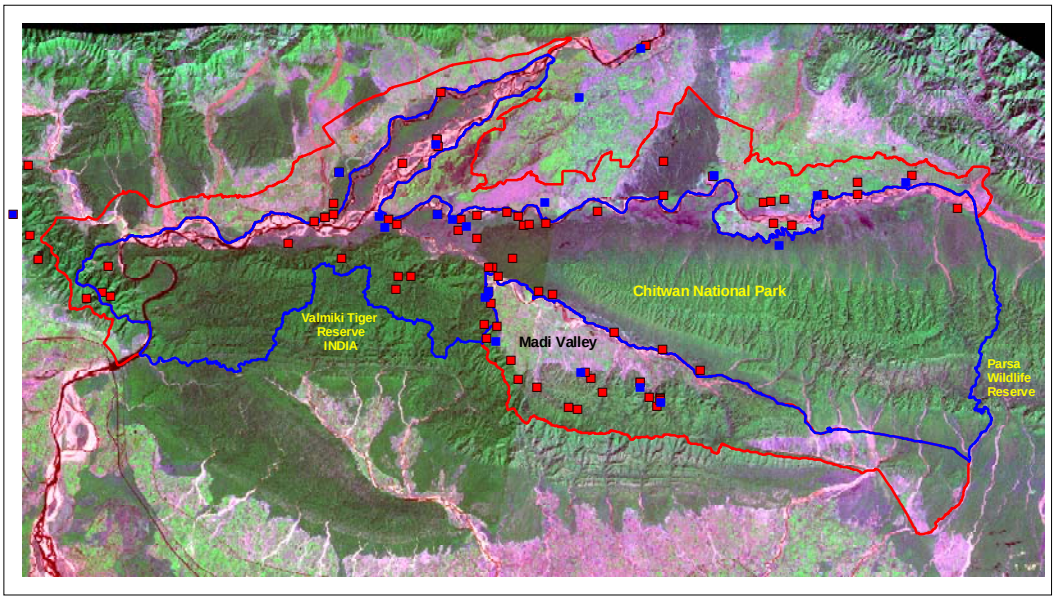
Tiger Human Conflicts: Investigating Ecological and Sociological Issues of Tiger Conservation in the Buffer Zone of Chitwan National Park, Nepal

Final Report



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By

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DEDICATION

This report is dedicated to Dr. Tirtha Man Maskey, Mr. Mingma Norbu Sherpa, Dr. Chandra Prasad Gurung and Mr. Narayan Poudyal who died on the helicopter crash on September 23, 2006. Their vision, encouragements, enthusiasm and support made this project a reality. We thank Mr. Sherpa and Dr. Gurung for their commitment to fund the project and Dr. Maskey and Mr. Poudyal for endorsement.

We thank them for their dedication and commitment to conserving the extraordinary natural resources / biodiversity of Nepal. Their outstanding effort in conservation contributed significantly enhanced excellence role model for others to emulate. They were respected conservationists and will be deeply missed by all of us.

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EXECUTIVE SUMMARY

Historically, there was contiguous forest all across the terai region of Nepal and tigers were distributed in high densities. The situation changed during early 1960s because the tiger habitat in the terai was drastically reduced as a result of human resettlement program. The destruction of habitat and fragmentation lead to the sharp decline in tiger population. Sport hunting and poaching also contributed to its decline. Like other tiger range countries Government of Nepal worked to overcome this crisis since early 70s. Protected areas were established, strict protection was adopted, and stiffer wildlife laws against wildlife criminals were endorsed. To further increase the land base for tigers buffer zone community forests around the parks and reserves were promulgated and moreover, Nepal initiated an ambitious Tarai Arc Landscape project not only to increase land base for tigers but also to restore connectivity between reserves.

Tiger conservation effort in Nepal has been successful. After establishment of protected areas in the early 1970s tiger numbers increased and since late 1970s numbers have been stable in protected areas. Density, based on mean female home range size, is the highest anywhere. The improvement of habitat quality in the buffer zone of Chitwan National Park and elsewhere across the terai has increased the overall land base where tigers reside. Breeding has been recorded at five sites outside of protected areas.

Such increase in habitat use by tigers in the multiple use buffer zone community forests resulted in conflict between tiger and human. Over the last quarter of a century 88 people have been killed by tigers in and around the park.

The trend of human loss has been increased significantly from an average of 1.5 persons per year (1979 – 1998) to 8.25 per year since 1999. The increasing trend of people killed was significant in the buffer zone but not inside the park. A total of 37 tigers were involved in killing 88 people. Of these, 17 were removed because of their man-eating behavior. The number of problem tigers removed per year increased dramatically in 2004-05. Four relevant factors were associated with man-eating tigers: (1) injured or aged tigers find it difficult to kill natural prey, (2) imbalance between tiger and prey base, (3) aggressive tiger behavior and, (4) defensive or accidental killing. Management actions were not taken against if it appeared that tigers killed humans accidentally; however, if possible the tigers that turned into deliberate "man-eaters" were removed.

A high percentage (38%) of humans killed by tigers occurred in the south sector of the park, i.e. Madi Valley. This study focused on the status of tigers and its prey in Chitwan National Park and in the Madi Valley buffer zone. Tiger and prey were relatively more abundant in the park than buffer zone. However, the disturbance factors, measured as encounter rate of livestock and human were significantly higher in the park than the buffer zone. Reduced human activity in the buffer zone as compared to the park is because there is a stronger incentive to local people to control local use of buffer zone forest.

Support of local people is critical in tiger conservation in the human dominated landscape. To understand the perceptions of Madi population towards tigers and its conservation, a household questionnaire survey was conducted. Majority of the people in Madi valley did not like tigers in the neighboring forests

because of threat to people and livestock. However, just less than half of the people liked tigers because of ecological, utilitarian, and moral values.

To mitigate the conflict the study recommends establishing a system to regularly monitor tigers in cooperation with the local "Bagh Heralus" attached to each community forestry user committee. Each committee in cooperation with Park staff would supervise the "Bagh Heralu" and the overall goal of the tiger and prey monitoring program would be to understand the activity pattern of tigers living in the buffer zone, implement a tiger conservation awareness program designed to educate local people on tiger biology and research, and to create a problem tiger response team to act immediately and efficiently to assist in conflict situations.

Local participation between local user groups in Madi valley and park staffs is also needed to reduce grazing along the southern border of the park.

INTRODUCTION

Until the turn of the 20th century, the tiger (*Panthera tigris*) ranged widely throughout Asia, including the Caspian region in the west into the Indian subcontinent, the far east of Russia, southeast Asia and the Sunda Islands. Its population sharply declined during the late 20th century primarily due to habitat destruction and fragmentation, sport hunting, and eradication of problem tigers by various means (McDougal 1987). Tiger habitat has now shrunk to < 5% of its historical distribution and three tiger sub-species have gone extinct. Approximately, 5000 to 7000 tigers estimated in the mid 1990s survive in the wild (Jackson 1997) and the numbers have declined in India, Cambodia, Vietnam and elsewhere in the past 10 years. Furthermore, tigers are distributed in small isolated populations and the consequence of small population size in long term viability is poorly understood.

A tiger requires large areas of undisturbed habitat and abundance of wild prey species. It cannot be saved in a small and isolated fragmented habitat (Smith et al.1987, 1998). This requirement of tigers led tiger biologists and conservationists to design a framework that identified key areas for tiger conservation (Dinerstein et al. 1997). Nepal's terai was identified as one of the pristine habitat for long term tiger conservation in the Indian sub-continents.

The government of Nepal has been actively working towards the protection and conservation of the Royal Bengal tiger (*Panthera tigris tigris*) one of the six (Luo et al. 2004) surviving sub-species for the last four decades. It is estimated approximately 120 breeding adults inhabit the four protected areas in

the lowland of Nepal (Smith et al 1999). Additionally, unknown numbers of breeding and dispersing tigers are distributed widely in the unprotected forest region of the terai (Gurung 2002).

Historically, there was contiguous forest all across the terai region of Nepal and tiger density was relatively very high (Smythies 1942). For example, during one hunt in 1938-39 organized in Chitwan 120 tigers were killed (Smythies 1942). Despite these large hunts, tiger numbers recovered and stayed stable in part because habitat remained intact. Hunts were organized only every few years, providing time for the population to recover. However, the situation changed during early 1960s because the tiger habitat in the terai was drastically reduced due to habitat loss and fragmentation as a result of a government sponsored human re-settlement program (Gurung 1983, Pradhan and Parks 1995). Hunters and settlers not only cleared the forest for agriculture, but also ruthlessly persecuted tigers to a critically low in the early 1970s.

To overcome this crisis the government of Nepal enacted the National Park and Wildlife Conservation Act 2029 in 1972. As a result of the act Chitwan National Park (CNP) the first protected area in Nepal, was created in 1973. Throughout 1970s and 1980s four other parks and reserves were created in the terai. Strict protection was adopted inside the parks and reserves to stop the alarming loss of forests and to recover populations of tiger, their prey, rhinoceros and other endangered wildlife species. Additionally, many villages occurring within parks were resettled to the periphery (Gurung 1983, Dhakal 2006). To further increase the land base for tigers and to decrease the human pressure on the

park, buffer zone community forestry around the parks and reserves were promulgated in 1996 (DNPWC / MFSC 1999, Dinerstein et al. 1999). Based on the small population sizes of tigers in Chitwan, Bardia and other terai tiger populations, Smith et al. (1998) advocated a metapopulation approach to tiger management. The goal was to re-establish the potential for dispersal and thus genetic exchange and demographic rescue. This recommendation lead to the creation of the Terai Arc Landscape (TAL) project (WWF 2001), in which the government of Nepal initiated an ambitious landscape scale project to increase the land base for tigers (Smith et al 1999) and restore connectivity between reserves (Wikramanayake et al. 2004).

A specific goal of TAL is to re-establish historical forest connectivity by restoring degraded national forest lands. Currently, the geographic structure of tigers in the Himalayan lowlands is a series of isolated or semi-isolated populations extending from Parsa Wildlife Reserve in the east to Corbett Tiger Reserve ~ 750 km to the west (Smith et al 1998, WWF 2001). TAL is working towards landscape forest restoration through community forestry and forest restoration. The goal is not only to increase the land base for tigers but also to benefit local people by restoring ecological services and economic benefits that these forests once provided.

To provide a scientific basis for tiger management the Smithsonian Institution and the Nepalese Government established the Smithsonian Tiger Ecology Project. The initial research team was composed of John Seidensticker and Kirti Man Tamang. Mel Sunquist, James L. David Smith and Hemanta

Mishra followed in that order and in 1983 Smith and Mishra drew up a plan to create Parsa Wildlife Reserve (Smith 1984). The Smithsonian Tiger Project stimulated a long term tiger and tiger prey research effort initiated by Seidensticker (1976) and McDougal (1977) and continued by Sunquist (1981), Tamang (1982), Smith et al (1983, 1984, 1987, 1989, 1991, 1998, 1999), Mishra (1982), Dhungel (1985), Ahearn et al (1990, 2001), Ahearn and Smith (2005). In early 80's a long term tiger monitoring (LTTM) project was initiated under the auspices of the Smithsonian Institution and was financially supported by International Trust for Nature Conservation (ITNC). The LTTM project used pugmark methodology and camera trapping (Barlow 2004).

These scientific studies cataloged behavior, life histories (Seidensticker 1976, McDougal 1977, Seidensticker and McDougal 1993), social structure (Sunquist 1979, 1981, Smith et al 1987, Sunquist and Sunquist 1988), impact on prey (Tamang 1982), communication (Smith et al. 1989), life time reproduction (Smith and McDougal 1991), dispersal (Smith 1993) and poaching (Kenny et al. 1995).

In spite of encouraging trends in creating and expanding tiger habitats and gaining ecological knowledge on tiger biology, poaching became a serious threat in the early 1990s as a result of new opportunities to sell bones and skin. Poaching of tigers was first noticed in CNP when few resident tigers suddenly disappeared from the study area of LTTM project. When tigers are killed and bones/skin removed there is little evidence of poaching. Nearly every part of the tiger is used in traditional Chinese medicine or in Asian folk remedies (Hemley and Mills

1999). Tiger bones have high demand and are mainly used for the treatment of rheumatism (Mills and Jackson 1994). Similarly, skins are highly prized for fashionable cloths and decorations. The government of Nepal took serious action to combat poaching by establishing anti-poaching units, information networks and a reward scheme. Additionally, the existing wildlife laws were amended by increasing fines and jail sentences from 5 years to 15 years for the wildlife criminals. The chief warden of the park was given the complete judiciary authority to punish the poachers and traders.

In addition to poaching, there is a serious problem of tiger human conflicts in the vicinity of CNP. The number of humans killed by tigers has dramatically increased from 1 - 2 per year prior to 1997 to 6.5 per year since that time (McDougal et al 2005). Man eating is the ultimate expression of human-tiger conflict and is a phenomenon that has proved difficult to explain from an ecological perspective. To date, most data on man-eating in Nepal is based on anecdotal observation (McDougal 1987). With forest restoration in the buffer zone of the parks and across TAL tiger numbers residing outside of park are increasing. Given the small size of tiger population in the protected areas the increased number of tiger living, and breeding outside of protected areas is a step toward increasing long term viability of Nepal's tiger populations. However, increased human killing by tigers, especially around CNP has the potential of creating a back lash against tigers. The TAL-Nepal strategy plan (2004-2014) (HMGN/MFSC, 2004) and the draft of 2nd Nepal Tiger Action Plan (2006) have identified human wildlife conflict as one of the direct causes of biodiversity loss

in the TAL region. The success of TAL's goal (to re-establish connectivity and use of corridor habitat by tigers) will depend to a large extent on mitigating tiger human conflict. In Nepal conservationists in and outside of the government are in agreement that this conflict must be addressed in a participatory process in which local people and the government work as a management team.

This research was undertaken to investigate systematically the ecological factors and sociological aspects of man-eating. Understanding both ecological and sociological aspects of man-eating will help park staff and local villagers to formulate management plans to reduce this conflict. Our study had the following objectives. 1) Map the distribution of human kills and tiger depredation, 2) establish a scientifically rigorous monitoring system for measuring prey abundance, 3) conduct baseline recce surveys to measure encounter rate of tiger sign, livestock grazing and other human forest use, 4) evaluate human attitudes towards tigers living in their area, and 5) formulate a plan to reduce man-eating.

STUDY AREA

Chitwan National Park and its Buffer Zone

The CNP was declared the first national park in 1973 and also designated a world heritage site by UNESCO in 1984. The park is situated in the south central part of Nepal. It is an inner terai or dun valley that occurs between the Siwalik outer range and the Mahabharat Range or "Middle Hills". This valley and its upper slope are inhabited by many large endangered wildlife species including tigers, Asian one horned-rhino (*Rhinoceros unicornis*), Asiatic elephant (*Elephas maximus*), Gaur (*Bos gaurus*), Gangetic dolphin (*Platanista gangetica*) and Gharial crocodile (*Gavialis gangeticus*).

Initially the park area was 544 km², which was later extended to the present size of 1040 km² in 1977. In 1996 a buffer zone was officially declared. It consisted of 750 km² of which 55% was agricultural land and 45% community forests (DNPWC and PPP 2000). Two protected areas Parsa Wildlife Reserve to the east and Valmiki Tiger Reserve to the south in India are adjacent to CNP and together they support one of the largest tiger populations in South Asia (Wikramanayake et al. 1998).

Madi Valley, on the southern border of CNP is a "dun" valley formed by the bifurcation of the Siwalik Hills. The south of Someshwor ridge forms the boundary of the buffer zone community forestry and also is the international boundary with India (Figure 1). The Someshwor range is a complex of deep ravines and steep slopes, with highest peak reaching an altitude of 870 m. The Churia range lies north of Madi inside the park and extends westward and

gradually loses height from 750 m on the eastern boundary to its western extremity near Bankatta Post. It meets with Someshwor ridge extending from south forming the narrow gorge of Reu River where the Reu exits Madi Valley. The buffer zone forests in the Madi Valley watershed encompass 45% of the entire buffer zone forest surrounding CNP (DNPWC and PPP 2000). These Madi community forests, lying to the south of cultivation lands, are comprised of 112 km² forests dissected by deeply eroded streams. The Reu River originates the tributaries that arise in the Someshwor and Churia ranges. This complex of streams provides critical water sources for ungulates as well as human populations in Madi Valley.

The Valley has been home to the ethnic group of Tharu people for hundreds of years until government of Nepal opened the area for other immigrants in early 50's. Since then thousands of hill immigrants have settled in the Madi Valley and they now outnumber the Tharu inhabitants. The 2001 census shows there were 39,314 people using 7211 ha of cultivated lands. The Valley is divided into four VDCs administrative units: Ayodhyapuri, Kalyanpur, Baghauda and Gardi (Figure 1).

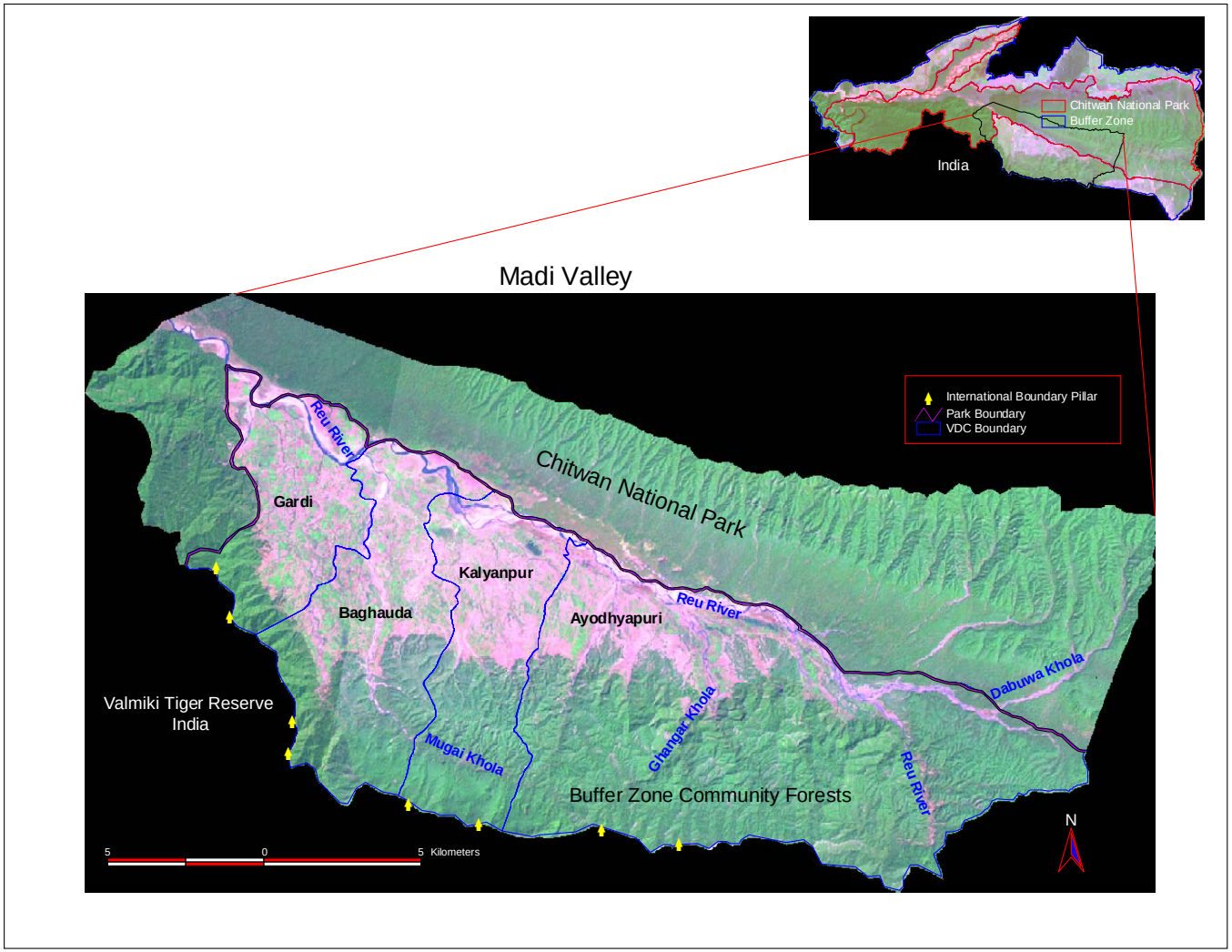


Figure 1. Study Area: Madi Valley, Chitwan National Park and Buffer Zone

METHODS AND STUDY DESIGN

General Methods and Design

Data on incidences of man-eating was collected from the park and all its surrounding buffer areas from December 2005 to June 2006. Data on tiger and prey abundance, livestock and human use of forests, and human attitude survey was collected from only the Madi Valley watershed including the buffer zone community forest in the south side of Madi Valley and the south slopes of the Churia (in the park) on the north side of Madi Valley.

Tiger abundance, livestock and human use of forests surveys were conducted during December 2005 to March 2006. The prey transect was conducted in April, and finally, a human attitude survey was conducted during the month of May and June 2006.

Investigation on Humans Killed by Tigers

Data on humans killed by tigers were obtained from various sources. Anecdotal data were gathered from the literatures, reports, newspapers, park records (RCNP 2004), and individuals (C. McDougal, B. Lama, H. Lama, D.B. Tamang, S. Kumal) who have been working on tiger monitoring in the park for 30 years or more. Information on victim's age, gender, victim's activity, and the time of incidence was verified by visiting each victim's family or a close relatives or person present at the time of the incidence. In the company of either the victim's family members or with the person who was present at the time (Figures 2, 3 and 4) each kill site was visited; Global Positioning System (GPS) locations, altitude, and vegetation type at the scene were recorded.

Figure 2. The family member of a person killed by a tiger show us the site where the kill was made.

Figure 3. A kill site visit is being shown by a local forest guard accompanied by national park game scout in Brandabhar Community Forest the site where a man was killed in March 24, 2001.

Figure 4. Army personnel, game scout, and local "Bagh Heralu" visit a site where a woman was killed in November 28, 2005 near Baghai Post in the eastern part of Madi Valley.

Investigation of Man-eating Tigers Removed by Human

To investigate the factors that lead to tiger killing human information on the tigers that were captured or killed was obtained. Reproductive status, gender, age class and physical condition were recorded. A complete record of problem tigers removed from the park was obtained from C. McDougal who has worked in the park for more than 30 years. This information was verified from records at the park headquarter, zoo, as well as from staff of the park and Nepal Trust for Nature Conservation (NTNC). The sites where a tiger was removed were also geo-referenced and habitat type recorded (Figure 5 and 6).

Figure 5. Bachcha Bhale a young man-eating tiger captured on May 31, 1991 near Munna Tal inside the Chitwan National Park. The tiger was turned into Kathmandu zoo and is one of the two surviving man-eating tiger in the zoo.

Figure 6. Sukram Kumal, a senior wildlife technician and naturalist from ITNC revisits the Harrabas area where Female 118 was darted after she killed a man in 1980.

Survey of Tiger, Livestock and Human Use of Forests

Team Training

To obtain data on livestock and human use of park and community forest we trained staff from the ITNC, the park and local villagers hired as "Bagh Heralu" (Gurung et al 2006). All the team members received instruction on using the GPS units. They were also trained to locate and identify tiger pugmarks (McDougal 1999), scent posts and scats, and to count livestock, and human encounters along the survey routes. Each survey team consisted of three or more members.

Data Collection

From December 2005 to March 2006 recce surveys of tiger sign, livestock numbers and types of human use were recorded on 58 routes included streams (n=27) and trails (n=8) and combination of both (n=23). Streams and river beds were chosen because there were greater chances of seeing tiger signs.

The Madi Valley watershed was divided into two blocks; park and buffer zone. The park was further divided into four sub-blocks and buffer zone into two sub-blocks. Each route survey was started between 9-10 am before human foot traffic obliterated tiger tracks. The survey normally ended between 4-5 pm. Distance traveled on each survey route was calculated using Arc View (version 3.3, ESRI, Redlands, CA). GPS locations were taken for each observation of tiger tracks, tiger scats, livestock observed, and humans encountered. The data were analyzed as the number of each type of observation per kilometer walked. Comparison was made between buffer zone and the park. Tiger scats and tracks along the tiger traveled route were geo-referenced. Encounter rate of tracks were calculated using the following criteria: 1. a track set that continued

along the trail or that vented off and re-entered the trail after short distance was counted as a single observation, 2. tracks of different ages at the same locality were counted separately, 3. tracks of different individual tigers based on the size criteria and shape were counted as separate observations.

Prey surveys

To obtain baseline data on relative prey abundance and compare prey densities between sites we adopted the approach used by Smith (1984) and Shrestha (2004). The technique is based on pellet group survey. The pellet group data were collected during the dry season in the month of April 2006. Transects were selected by systematic sampling in which survey blocks were well represented. Shrestha (2004) ignored the high ridge tops and barren areas in his sample but we conducted the survey in the barren areas and ridge tops to get a better representation of the entire study area. Starting points for each transects were selected prior to going to the field. At the site, a random compass direction was selected to avoid potential bias. Each transect or sampling unit (SU) was a 625 m long, with 25 circular plots spaced 25 m apart. Each plot was 10 m² in size (Smith 1984, Shrestha 2004). A 10 m² plot was chosen because large plots are difficult to survey in dense vegetation and difficult to count the pellets accurately.

Within the plot, litter was lightly and carefully raked to observe all the pellet groups. The detection probability was assumed to be 100%. Pellet groups were converted into sambar units based on the mean weight of a prey species as follows: gaur = 4, sambar = 1, wild boar = 0.31, chittal = 0.28, barking deer = 0.11 and monkey = 0.05. The density of pellet groups is presented as sambar unit/ per plot.

Household Attitude Survey

In order to investigate the human attitudes and perception towards tiger a quantitative household (hh) survey method were used. A total of 8,108 households are listed as resident in the four VDCs in Madi Valley (2001 Population census). However, 389 hh living outside of the Madi Valley watershed in the Bandarjhula were excluded from the study because we were interested in the attitude of the people living in the Madi Valley watershed only. In order to ensure a good representation of the population of interest (7,719 hh), we first determined to sample 400 hh from the Madi population. These 400 samples were first stratified according to the proportion of hh in each four VDCs (Table 1).

All Madi Valley hh were numbered in excel sheet. Random numbers were generated according to the number of samples to be drawn from each of the four VDCs (Table 2). The member of hh thus selected was interviewed. The questionnaires were developed after focus group discussions on tiger and its importance. The questionnaires were finalized after pilot tested in November 2005. Interviews were conducted to investigate the household representative's perceptions towards tigers. Eight local individuals with university undergraduate degrees were hired and trained to conduct the survey. All had some survey experiences and were involved in community services in different ways. Four survey assistants work at the buffer zone user committee office in Madi VDCs. Other survey assistants included a teacher and social workers active in community activities. Three of the interviewers were Tharu from two VDCs where 40 percent of the population belongs to their group. They were helpful in translating the Nepali questionnaire into their language.

RESULTS

Distribution of Humans Killed

88 persons were killed by the tigers in and around the CNP between 1979 to June 2006 (Table 3, Figure 7). Out of these, 43 (49%) lost their lives inside the park, 40 (45%) in the buffer zone and 5 (6%) beyond the buffer zone of the park. More than 38% of all reported kills occurred in the southern sector / Madi valley of the park (Figure 8). Approximately 66% of the victims were eaten.

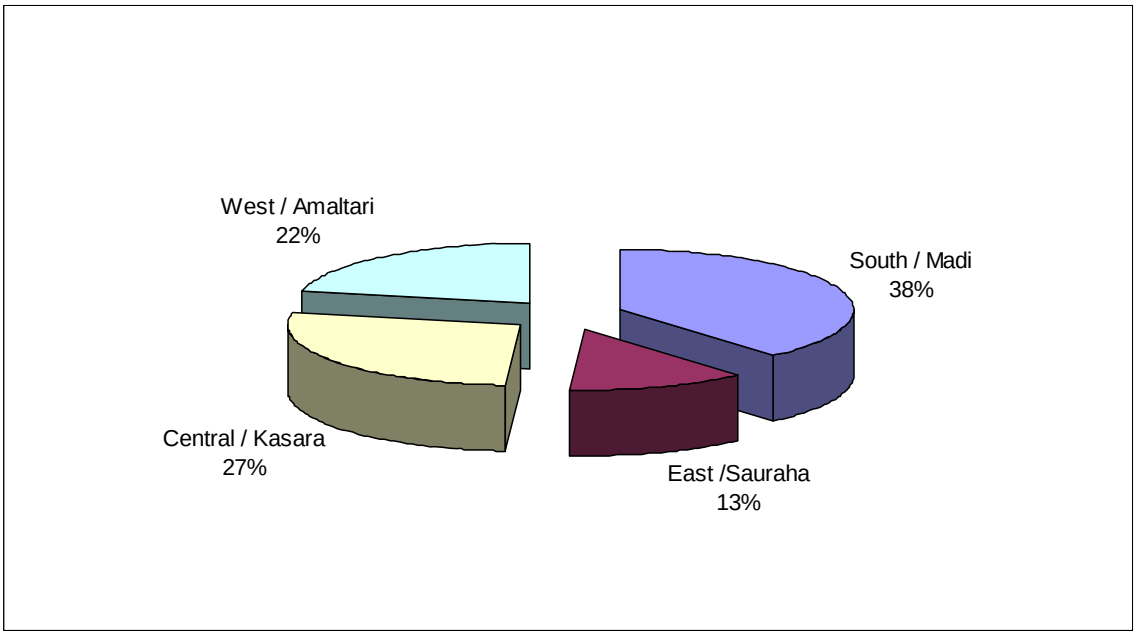


Figure 8. Humans killed by tigers in four management units of Chitwan National Park

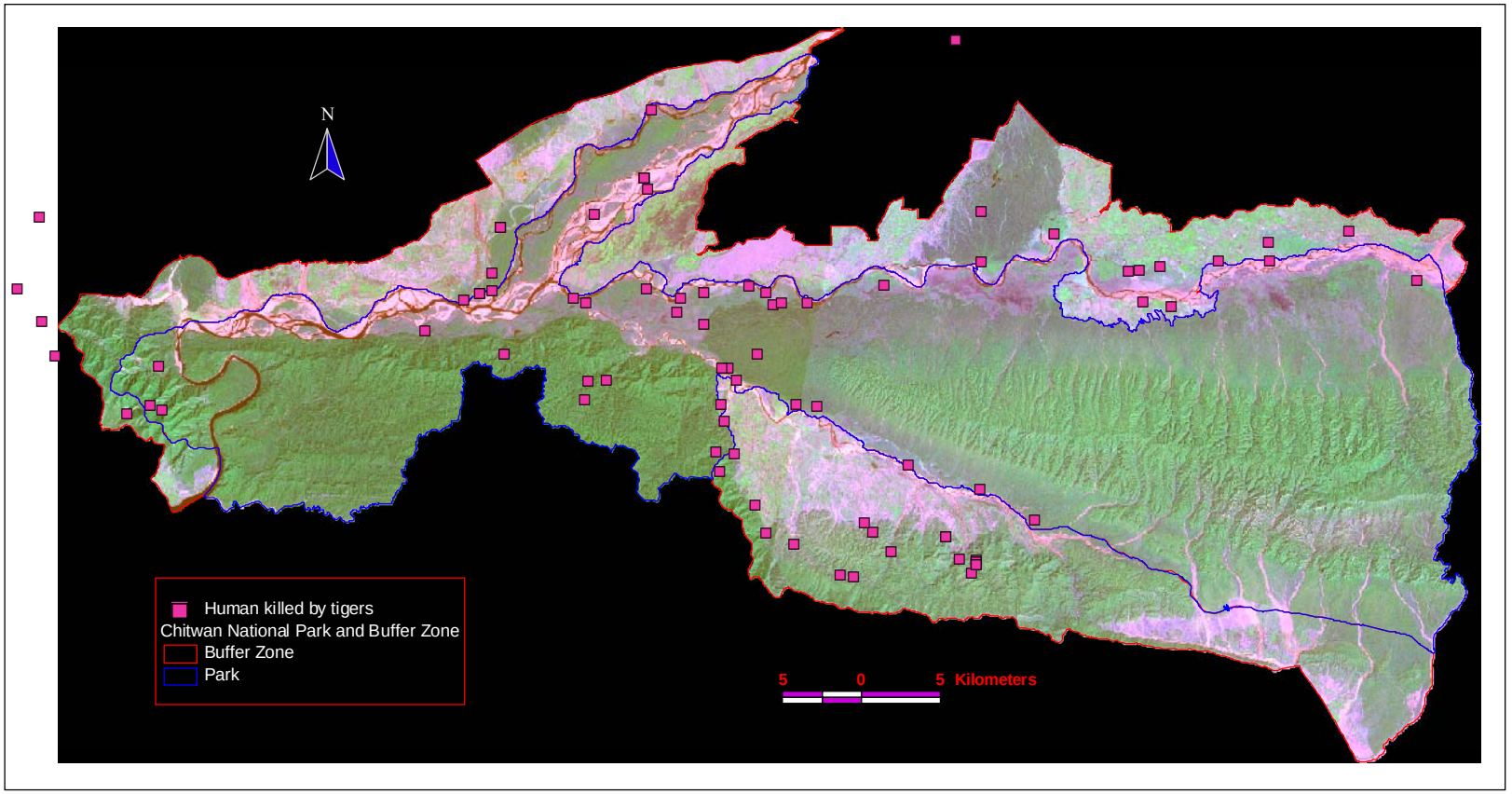


Figure 7. Locations of humans killed inside the park, buffer zone and beyond

Table 3. Number of man-eating tigers, age, sex, no. of people killed and disposition (P.S. Individual tiger is given Nepali name: Bhale for male and Pothi for Female)

Sno	Year	Tiger ID	Sex	Age	No. of Victim	Disposition
1	1979	M119	M	Immature	1	Captivity Zoo
2	1980	F118	F	Immature	1	Killed
3	1981	M127	M	Mature	4	Radio Collared tiger
4	1983	UK	F	UK	1	No Action
5	1985	Bange Bhale	M	Mature	3	Captivity Zoo
6	1986	Kanchha Bhale	M	Old Age	3	Killed
7	1988	Bankatta Pothi	F	Mature	4	No Action
8	1992	Chepte Pothi	F	Mature	3	Killed
9	1993	Bachcha Bhale	M	Immature	1	Captivity Zoo
10	1996	UK	UK	UK	1	No Action
11	1998	Baghmara Pothi	F	Old Age	1	Captivity Zoo
12	1998	Nuna Bhale	M	Old Age	6	Killed
13	1999	Syaulibas Pothi	F	Immature	1	Captivity Zoo
14	1999	Kantipur Pothi	F	Mature	2	Poisoned
15	1999	Nagarban Bhale	M	Immature	1	Relocated
16	2001	Ujeli Pothi	F	Mature	1	No Action
17	2001	Daunne Bhale	M	Mature	7	Killed
18	2001	Amp Pothi	F	Mature	4	No Action
19	2001	Sitalpur Bhale	M	Immature	5	Killed
20	2001	UK	UK	UK	1	No Action
21	2002	Tamor Pothi	F	Old Age	2	Relocated / killed
22	2002	Kujauli Bhale	M	Mature	1	No Action
23	2003	UK	UK	UK	1	No Action
24	2003	Bhimle Pothi	F	Mature	1	No Action
25	2003	UK	M	Mature	1	No Action
26	2004	Kasara Bhale	M	Old Age	2	Killed
27	2004	Ayodhyapuri Bhale	M	Immature	6	Killed
28	2004	UK	UK	UK	1	No Action
29	2004	UK	F	Mature	1	No Action
30	2004	Bhagedi Pothi	F	Mature	5	Killed
31	2004	UK	UK	UK	2	No Action
32	2004	Ayodhyapuri Pothi	F	Mature	5	Poisoned?
33	2005	Majurtika Pothi	F	Mature	2	No Action
34	2005	UK	M	Immature	3	Unsuccessful capture
35	2005	Madi Bhale	M	Mature	2	No Action
36	2005	UK	UK	UK	1	No Action
37	2006	UK	F	Mature	1	No Action
		Male	15		46	
		Female	16		35	
		Unknown	6		7	
	Total	**Tigers**	**37**	**Victims**	**88**	

In Chitwan the number of man-eating cases has increased significantly over the years (Figure 9). On average 1.5 persons per year was killed between 1979 to 1998. However, since 1999 number of victims killed has significantly increased to 8.25 per year. Number of victims inside the park and in the buffer zone was regressed separately with years. The increasing trend of people killed were significant for the buffer zone ($p=0.002$). However, the upward trend of human killing inside the park is not significant ($p = 0.143$).

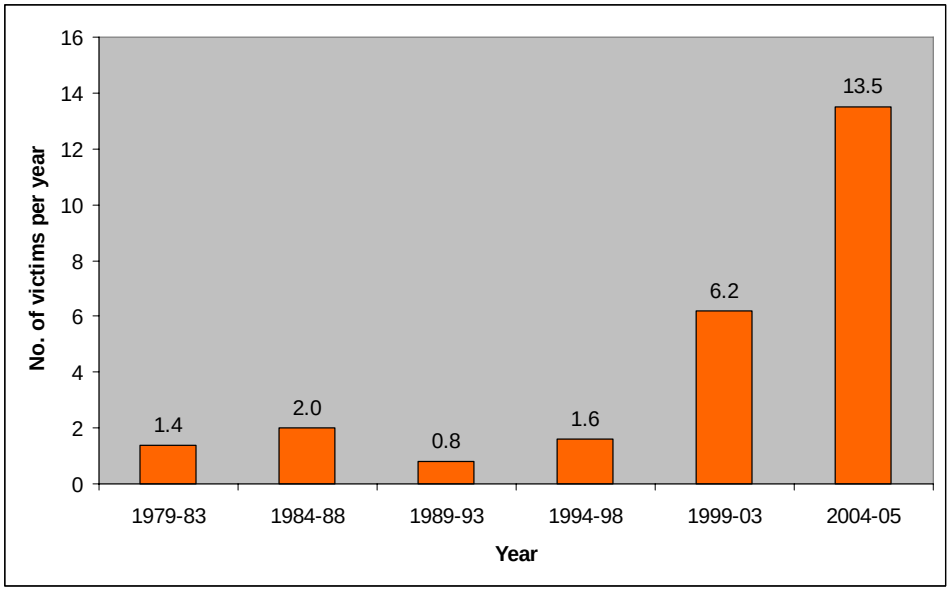


Figure 9. Number of victims killed per year in and around Chitwan National Park

About half the kills occurred, when people were collecting grass / fodder for their livestock (Figure 10). Tigers killed 5 people (6%) at home while sleeping at night. About 60% of the victims were men.

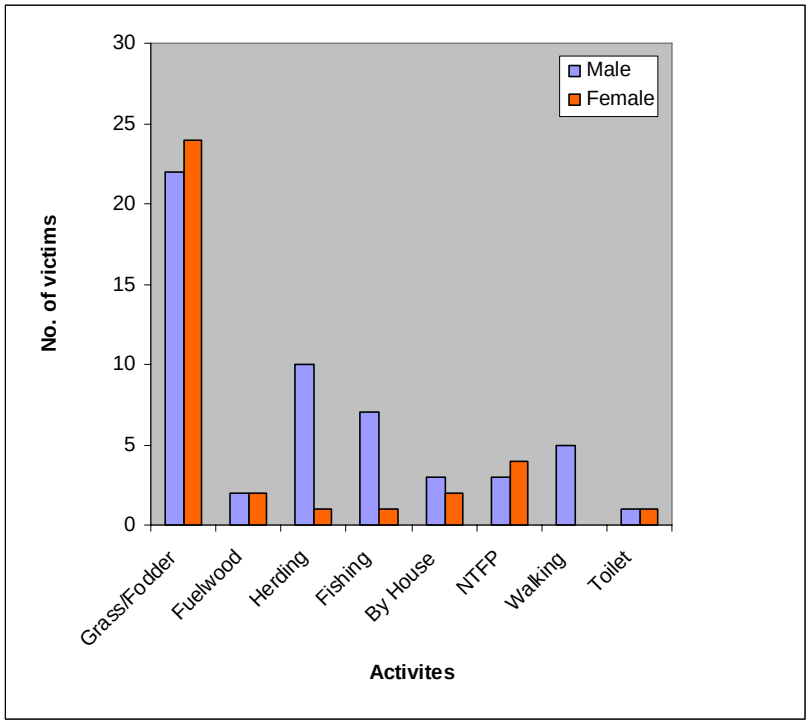


Figure 10. Male and female victim activity when killed by tiger

Youngest victim was 4 yrs old girl killed at home and oldest was 70 yrs old man killed collecting fodder for the goats. However, 50% of the victims were aged between 31-50 yrs old presumably people of that age group go to the forest in greater numbers than other aged group (Figure 11).

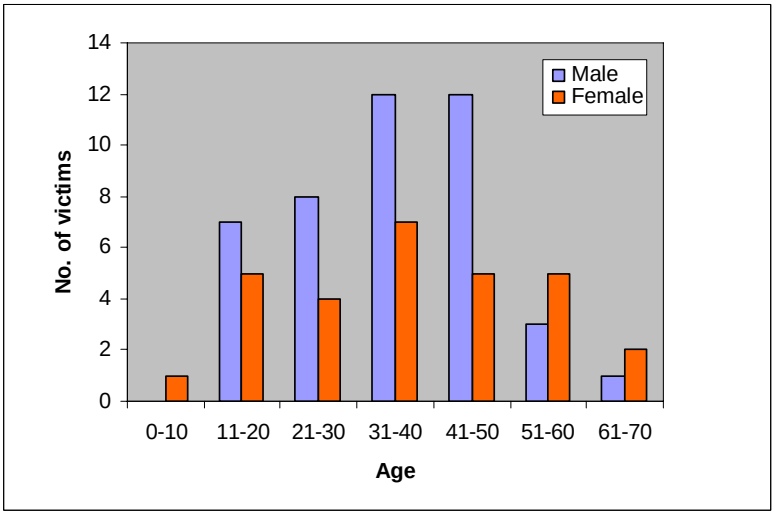


Figure 11. Age distribution of 72 victims of known age by gender

We categorized the kill time into five classes as follows: morning (6 am – 9 am), forenoon (9am – 12 noon), afternoon (12 noon to 3 pm), evening (3 pm to 6 pm) and night (from 6 pm to 6 am). More than 59% of victims were killed during forenoon and afternoon (Figure 12).

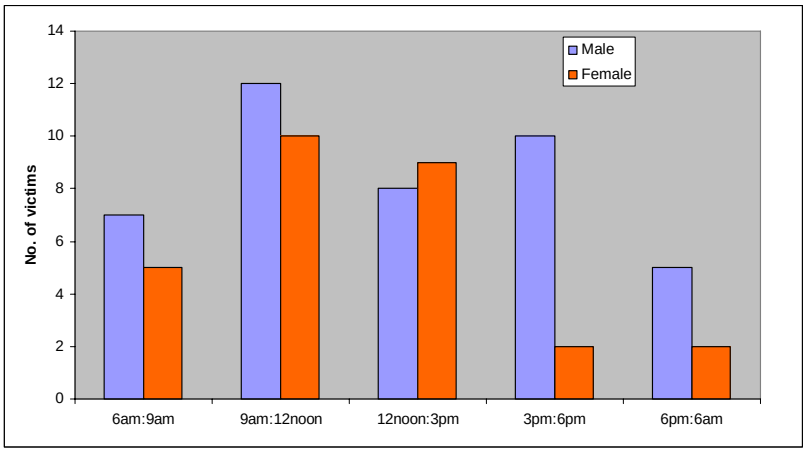


Figure 12. Victims killed during different time of the day

There was no seasonal difference in human killing by tigers (Figure 13). In summer season (15 Feb-15 Jun) slightly higher percentage (40%) of people were killed than winter (15 Oct - 15 Feb) and monsoon (15 Jun-15 Oct) seasons.

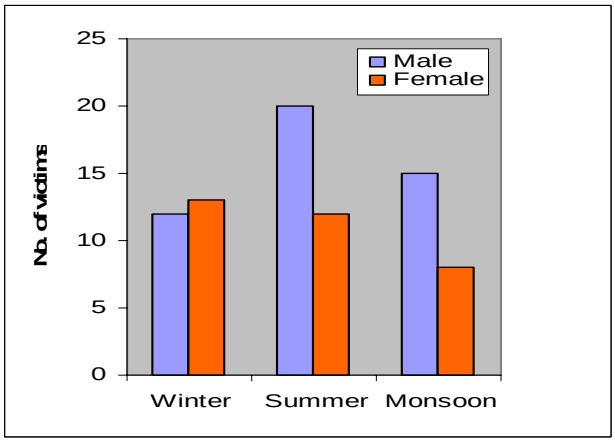


Figure 13. Victims killed at different seasons.

Problem Tigers Removed by Human

A total of 37 tigers were involved in killing 88 people between 1979 to June 2006 (Table 3). Of these 15 were males, 16 were females and 6 were of unknown sex. Seventeen animals were captured or killed: 8 from the park, and 9 from buffer zone and national forest (Table 4). In addition to man-eaters, eight more tigers were removed where they were creating serious threat to the people (Table 4, Figure 14).

Table 4. Removed problem tigers by sex, age, number of victims, disposition from park (P), buffer zone (BZ) and national forest (NF)

Sno	Year	Tiger ID	Sex	Age	No. of Victim	P/BZ/NF	Disposition
1	1979	M119	M	Immature	1	P	Captivity Zoo
2	1980	F118	F	Immature	1	P	Killed
3	1984	Bange Pothi	F	Old Age	0	P	Captivity Zoo
4	1985	Madi Baruwa Pothi	F	Old Age	0	P	Killed
5	1985	Bange Bhale	M	Mature	3	P	Captivity Zoo
6	1986	Kanchha Bhale	M	Old Age	3	P	Killed
7	1992	Chepte Pothi	F	Mature	3	BZ	Killed
8	1993	Bachcha Bhale	M	Immature	1	P	Captivity Zoo
9	1998	Baghmara Pothi	F	Old Age	1	BZ	Captivity Zoo
10	1998	Nuna Bhale	M	Old Age	6	P	Killed
11	1999	Syaulibas Pothi	F	Immature	1	BZ	Captivity Zoo
12	1999	Nagarban Bhale	M	Immature	1	NF	Relocated
13	1999	Kantipur Pothi	F	Mature	2	BZ	Poisoned
14	2001	Rampur Pothi	F	Immature	0	NF	Relocated
15	2001	Sitalpur Bhale	M	Immature	5	P	Killed
16	2001	Daunne Bhale	M	Mature	7	BZ	Killed
17	2002	Gardi Pothi	F	Mature	0	BZ	Poisoned
18	2002	Tamor Pothi	F	Old Age	2	BZ	Relocated / killed
19	2004	Bhagedi Pothi	F	Mature	5	P	Killed
20	2004	Bhagedi Cub I	F	Cub	0	BZ	Killed
21	2004	Bhagedi Cub II	F	Cub	0	BZ	Captivity Kasara
22	2004	Bhagedi Cub III	M	Cub	0	BZ	Killed
23	2004	Kasara Bhale	M	Old Age	2	BZ	Killed
24	2004	Ayodhyapuri Bhale	M	Immature	6	BZ	Killed
25	2005	Jagatpur Pothi	F	Immature	0	BZ	Killed

There has been a striking increase in problem tiger removal from the buffer zone and park since 1999 (Table 4). Number of tigers removed per year increased dramatically in 2004-05 (Figure 15). Out of 25 problem tigers fifteen were removed from the buffer zone / national forests and 10 from the park. Of all the problem tigers 60% (n=15) were killed, 24% (n=6) were captured and kept in captivities and 16% (n=4) were captured and released at different locations inside the park.

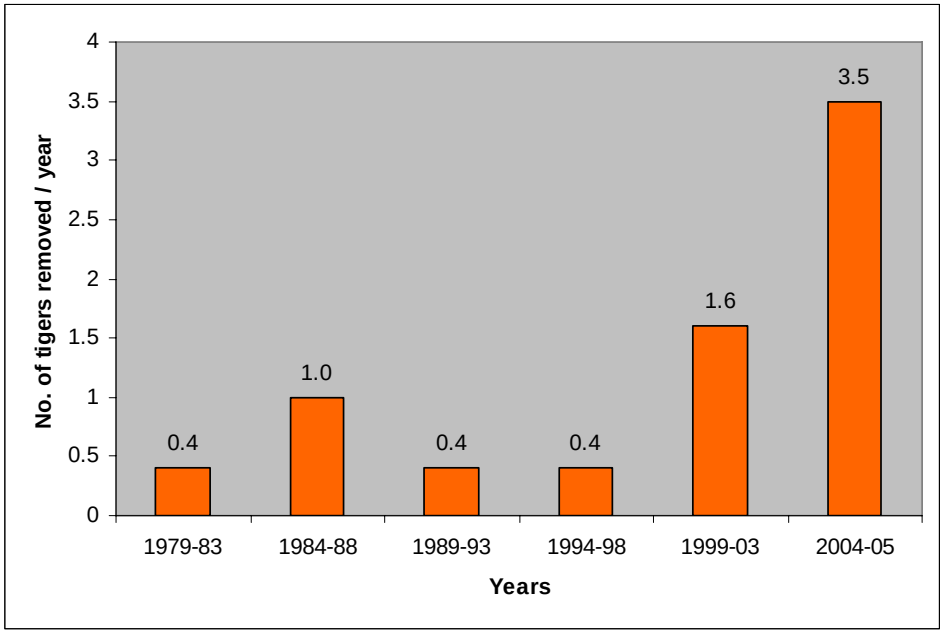


Figure 15. Number of tigers removed per year from the park and surrounding areas

The relevant factor of man-eating was assessed from the 17 man-eating tigers (Table 5a). Nine of those tigers were impaired due to old age, fight with other tigers or gunshot wound (Table 5b). Aged, mature, and immature tigers fell into this category. Three of the victims killed in the house were by two aged tigers. Ten of the removed man-eating tigers were living in the low prey density, sub-optimal and marginal habitats. All three age class tigers belonged to this category. Aged tigers are displaced into the marginal and sub-optimal habitats by the stronger opponent tigers due to territorial fight.

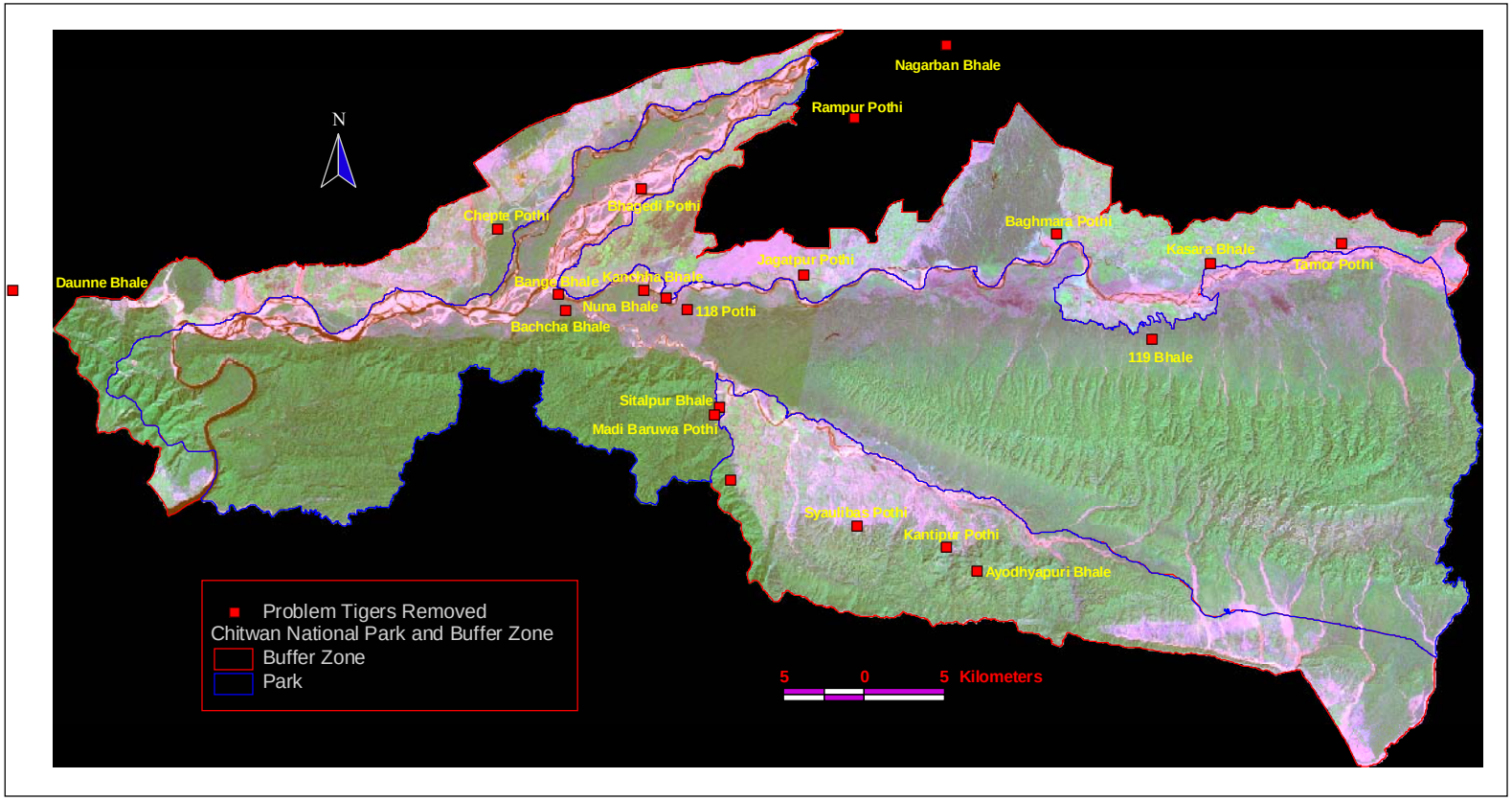


Figure 14. Locations where 17 man-eating tigers and other problem tiger's were removed

Mature females with cubs could have food limited as grown up cubs requires almost the equal amount of food as adults (Table 5a). Immature tigers are dispersal and often reside in the sub-optimal habitat when prime habitats are occupied by the resident individuals. Two immature male (Sitalpur Bhale and Ayodhyapuri Bhale) in this category killed 11 people in Madi and Chepte Pothi females with cubs killed 3 people. It is straightforward to understand why impaired or starving tigers killed people because of hunger, they are unable to hunt natural prey. However, it is difficult to explain why tigers without disabilities, and living in a high prey base area kill people. We categorized such man-eating tigers as aggressive. Such aggressive behavior was observed during the man-eating incident or darting operations (Table 5b).

Table 5a. Physiological and psychological conditions of 17 "man-eating" tigers. (* Female with 2 large cubs and ** female with 3 cubs)

Sno.	Tiger ID	Sex	Age category	Physiological/ Psychological State	Habitat
1	Male 119	M	Immature	Impaired	Prime
2	Female 118	F	Mature	Aggressive	Prime
3	Bange Bhale	M	Mature	Impaired	Prime
4	Kanchha Bhale	M	Aged	Impaired	Prime
5	Chepte Pothi*	F	Mature	Not Impaired	Sub-optimal
6	Bachcha Bhale	M	Immature	Aggressive	Prime
7	Baghmara Pothi	F	Aged	Impaired	Sub-optimal
8	Nuna Bhale	M	Aged	Impaired	Prime
9	Kantipur Pothi	F	Mature	Not Impaired	Sub-optimal
10	Syaulibas Pothi	F	Immature	Impaired	Sub-optimal
11	Nagarban Bhale	M	Immature	Not Impaired	Sub-optimal
12	Sitalpur Bhale	M	Immature	Not Impaired	Sub-optimal
13	Daunne Bhale	M	Mature	Impaired	Sub-optimal
14	Tamor Pothi	F	Aged	Impaired	Prime
15	Kasara Bhale	M	Aged	Impaired	Sub-optimal
16	Bhagedi Pothi**	F	Mature	Not Impaired	Sub-optimal
17	Ayodhyapuri Bhale	M	Immature	Aggressive	Sub-optimal

Table 5b. Relevant factors in the cases of 17 "man-eating" tigers from table 5a lists.

Tiger	Impaired by age / injury	Sub-optimal habitat	Usually aggressive
Aged tiger	5	2	0
Mature	2	4	1
Immature	2	4	2
Total	**9**	**10**	**3**

Monitoring of tiger prey in Madi Valley

We established 54 permanent (geo-referenced) preys transects (Table 6, Figure 16) in the Madi Valley watershed. Nineteen transects are in the buffer zone and 35 inside the park which are further divided into sub-blocks (5 sub-blocks inside the park and 3 sub-blocks in the buffer zone), covering an area of 281 km² (Table 6, Figure 16).

Tiger prey was relatively more abundant in the park than buffer zone forests (Table 6). However, one of the park block (Pandunagar) lying to the south of Madi had an equal prey abundance (0.27) as Paurai and Reu blocks in buffer zone. Relatively low prey abundance was observed in Mugai khola block (0.03) in the buffer zone compared to other blocks.

Table 6. Prey abundance in the park and buffer zone of Madi Valley

Sno	Block Name	Area (sq km)	No. Transect	Mean Sambar unit	STDEV
1	Mugai Khola	39	6	0.03	0.03
2	Paurai Khola	41	7	0.27	0.18
3	Reu	39	6	0.27	0.19
	Buffer Zone	**119**	**19**	**0.19**	**0.09**
4	Baghai	53	7	0.69	0.40
5	Ghanger	37	8	0.42	0.16
6	Bankatta/Dhoba	18	8	0.43	0.12
7	Bote Simara	31	8	0.53	0.29
8	Pandunagar	23	4	0.27	0.29
	Park	**162**	**35**	**0.47**	**0.11**

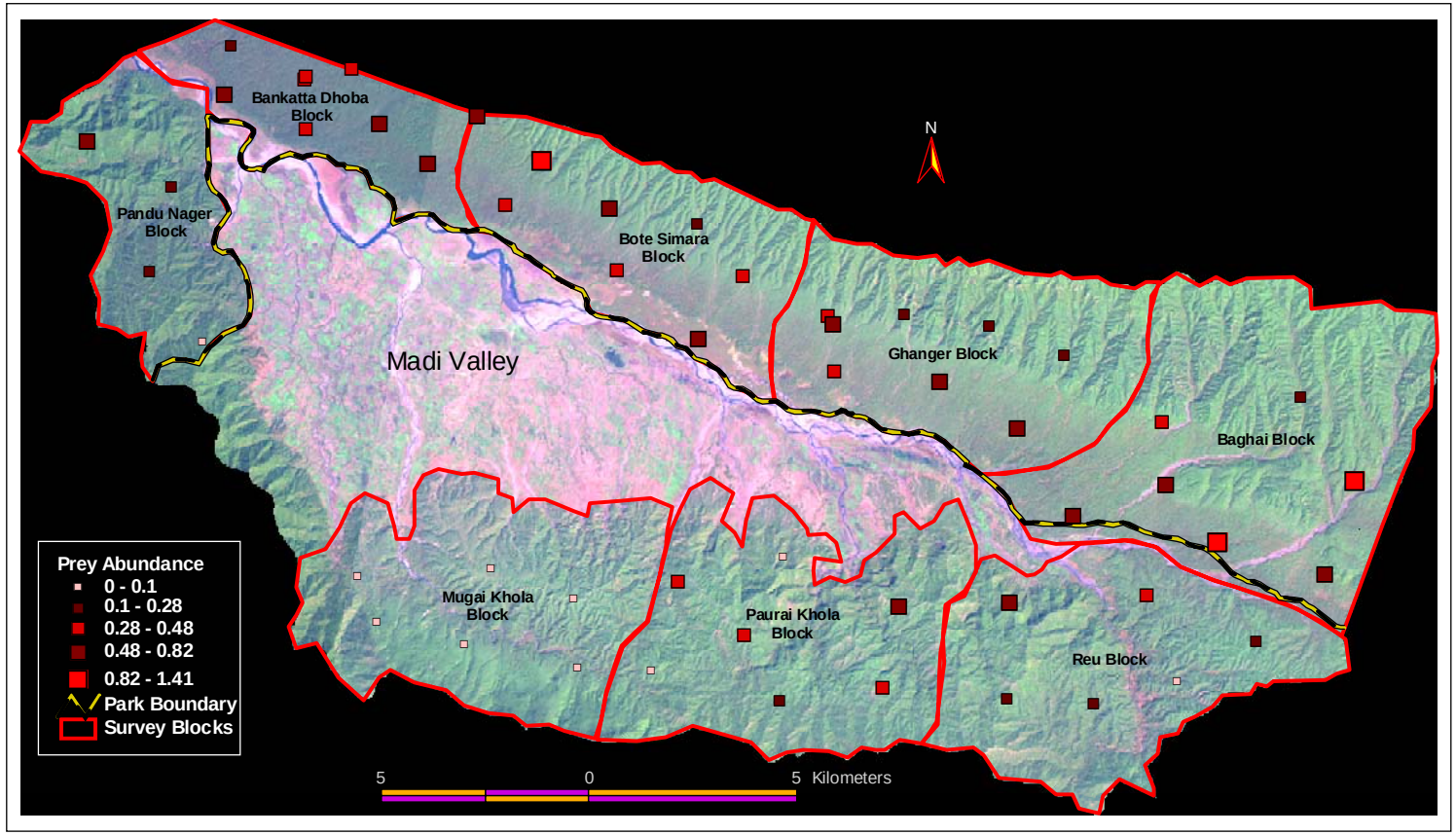
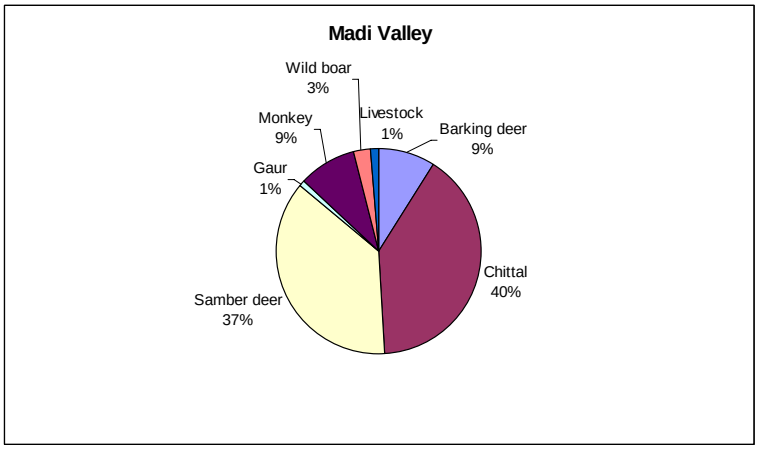
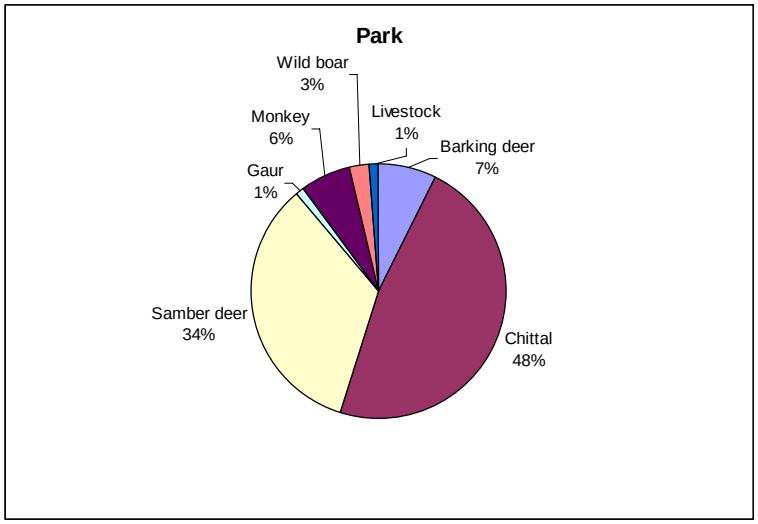


Figure 16. Tiger prey abundance in Madi Valley

Sambar (34%) and chital (48%) pellet group dominated the prey species composition inside the park (Figure 17). However, in the buffer zone sambar (49%) remained dominated but chital (8%) composition was relatively low than the park. Domesticated livestock (cow and water buffalo) contributed 1% in the park and 3% in the buffer zone.





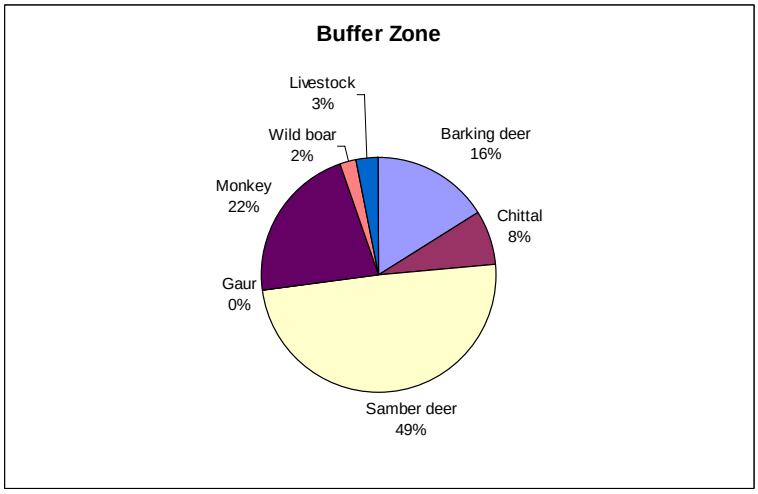


Figure 17. Ungulate species composition in Madi Valley, Park and Buffer zone

Monitoring of tiger and human use in Madi Valley

Table 7 summarizes the results of routes surveyed related to number of kilometers walked, number of tigers and leopard track sets observed, livestock and human encountered. Encounter rate for tiger and leopard track sets are calculated by adding the total number of independent track sets divided by the total km walked. Similarly, encounter rate for livestock and people as a disturbance factors are calculated by totaling number of livestock and people seen divided by total distance walked.

Table 7. Counts and encounter rates in parentheses (no. /km) of livestock and people seen and tiger and leopard track sets encountered in the Madi Valley.

Block	Area km²	No. of route	Km walked	Livestock	People	Tiger track set	Leopard track set
Ayodhyapuri	77	13	72	83 (1.15)	91 (1.26)	7 (0.10)	15 (0.21)
Mugai Khola	49	12	65	16 (0.25)	295 (4.54)	9 (0.14)	8 (0.12)
Pandunagar	25	4	25	35 (1.40)	76 (3.04)	3 (0.12)	9 (0.36)
Dhoba	44	9	66	1557 (23.59)	331 (5.02)	6 (0.09)	3 (0.05)
Ghanger	36	9	66	687 (10.59)	276 (4.18)	9 (0.14)	8 (0.12)
Baghai	70	11	71	408 (5.75)	178 (2.51)	20 (0.28)	12 (0.17)
Buffer Zone	**126**	**25**	**137**	**99 (0.72)**	**386 (2.82)**	**17 (0.12)**	**23 (0.17)**
Park	**175**	**33**	**228**	**2687 (11.79)**	**861 (3.78)**	**38 (0.17)**	**32 (0.14)**
Total	**301**	**58**	**365**	**2786 (7.63)**	**1247 (3.42)**	**54 (0.15)**	**55 (0.15)**

A total of 365 km in 58 routes were surveyed in approximately 300 km² of Madi Valley watershed. Tigers and leopards both occurred in all 6 study blocks (Figure 18). The encounter rate of tiger tracks in the park was greater then the buffer zone (χ^2 =3.14, df=1, p= 0.076), however, leopard encounter rate in the park and buffer zone were exactly as expected (χ^2 =0, df=1, p= 1.0). Similarly, the encounter rate of tiger tracks and leopard tracks did not differ significantly between park (χ^2 =2.26, df=1, p=0.132) and buffer zone (χ^2 =0.9, df=1, p=0.342) (Table 7). The lowest encounter rate of tiger was in Dhoba block, which had the highest human activity, and highest encounter rate of tiger

are observed at Baghai block, which had the lowest human activity.

Our data on disturbance factors, measured as encounter rate of livestock and human use are shown in (Table 7, Figure 19 and 20). Livestock encounter rate was relatively high (11.17) in the park than buffer zone (0.72). Similarly, human forest use is relatively greater inside the park compared to buffer zone. However, these disturbances are more severe along the Reu River approximately 2 km inside the park south of the fire line (Figure 19 and 20). It is interesting to note that the livestock grazing inside the buffer zone community forests has been minimal and as User Group Committees enforce grazing restrictions in their forests, grazing has shifted the park. Relatively high livestock (23.59) and human (5.02) encounter rate is observed in Dhoba block inside the park, in contrast lowest rate of livestock (0.25) and human (1.26) are observed in Mugai and Ayodhyapuri buffer zone block respectively.

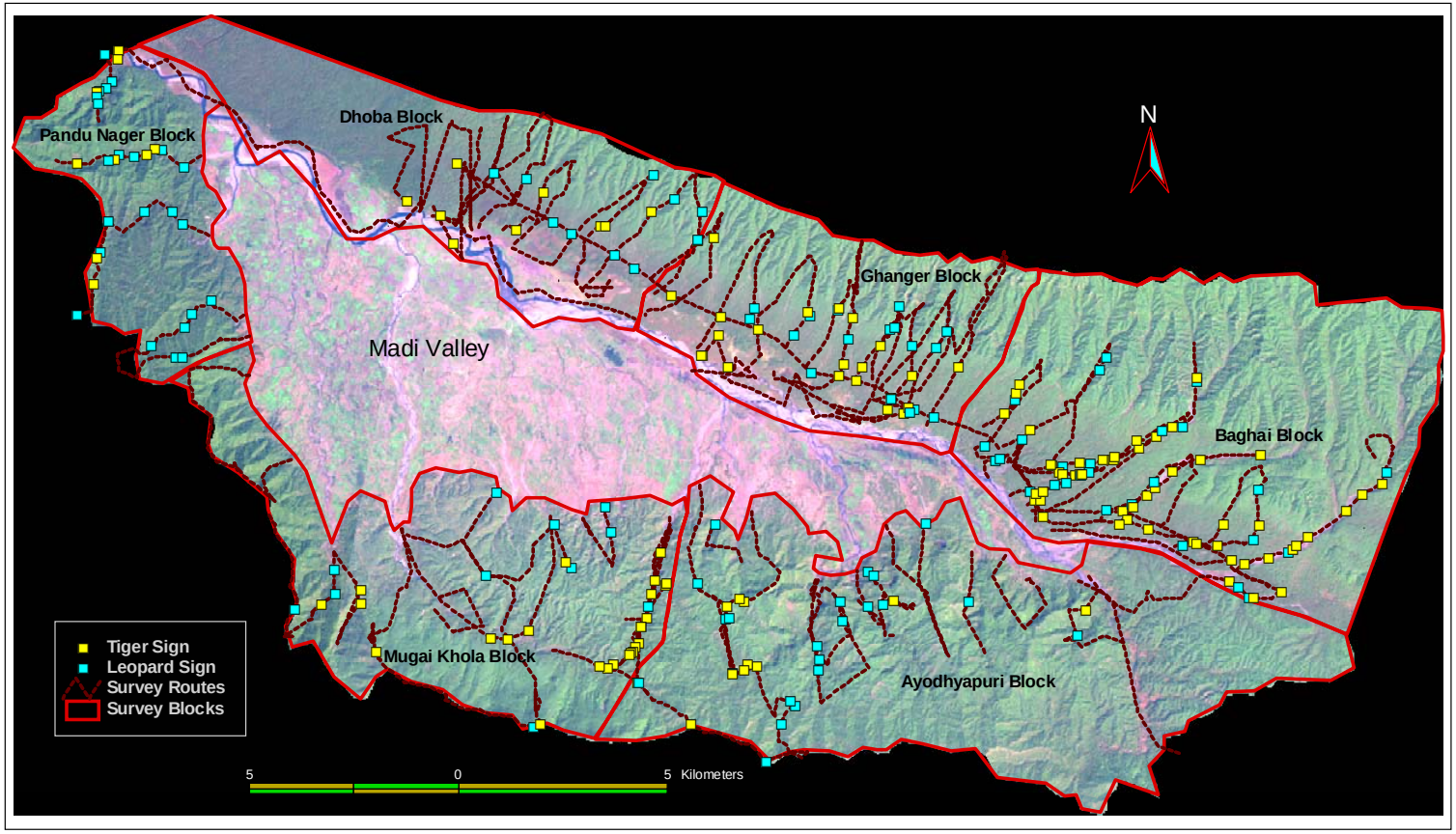


Figure 18. Locations of tigers and leopards sign in Madi Valley

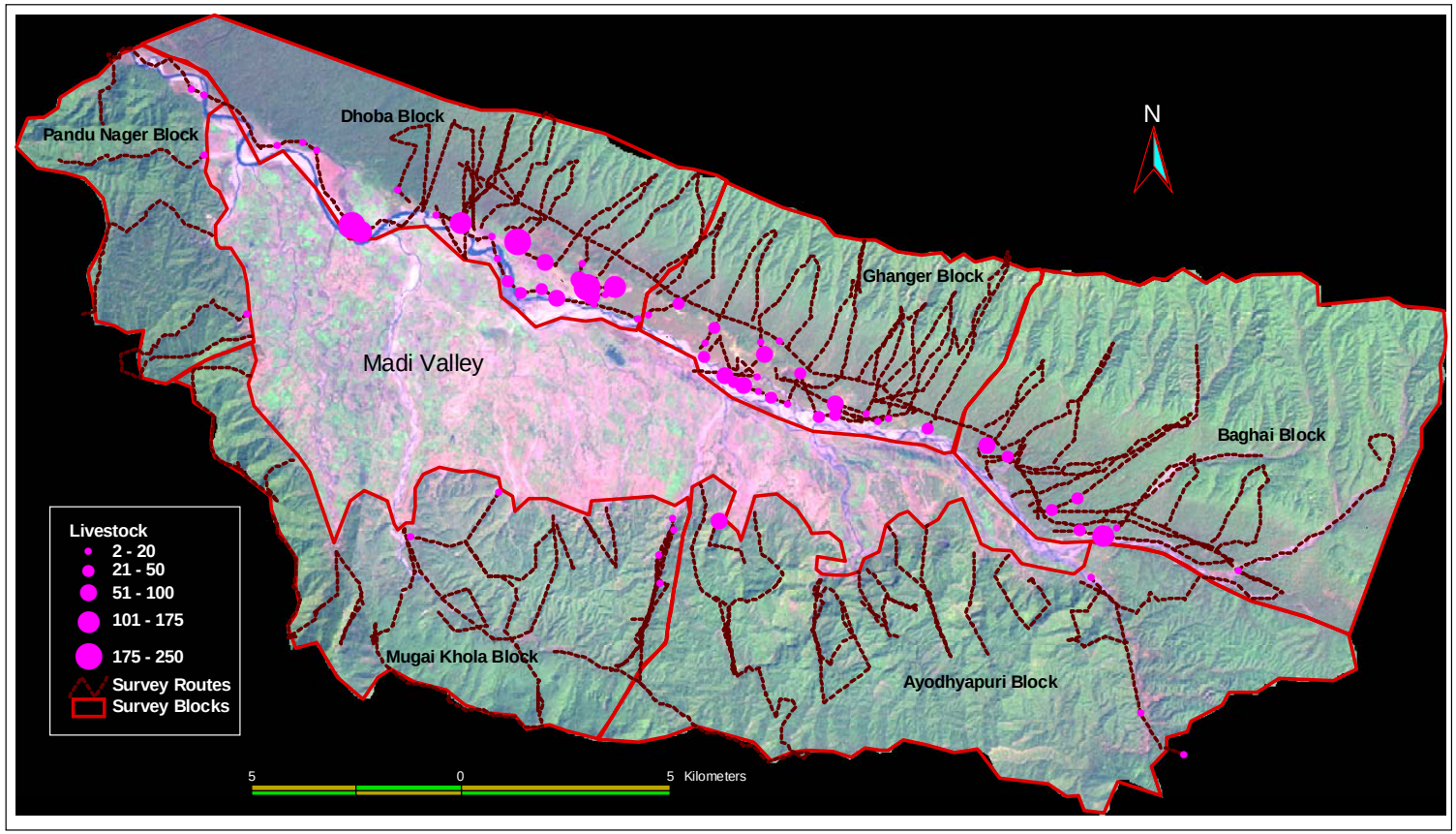


Figure 19. Number of livestock grazing in Madi Valley

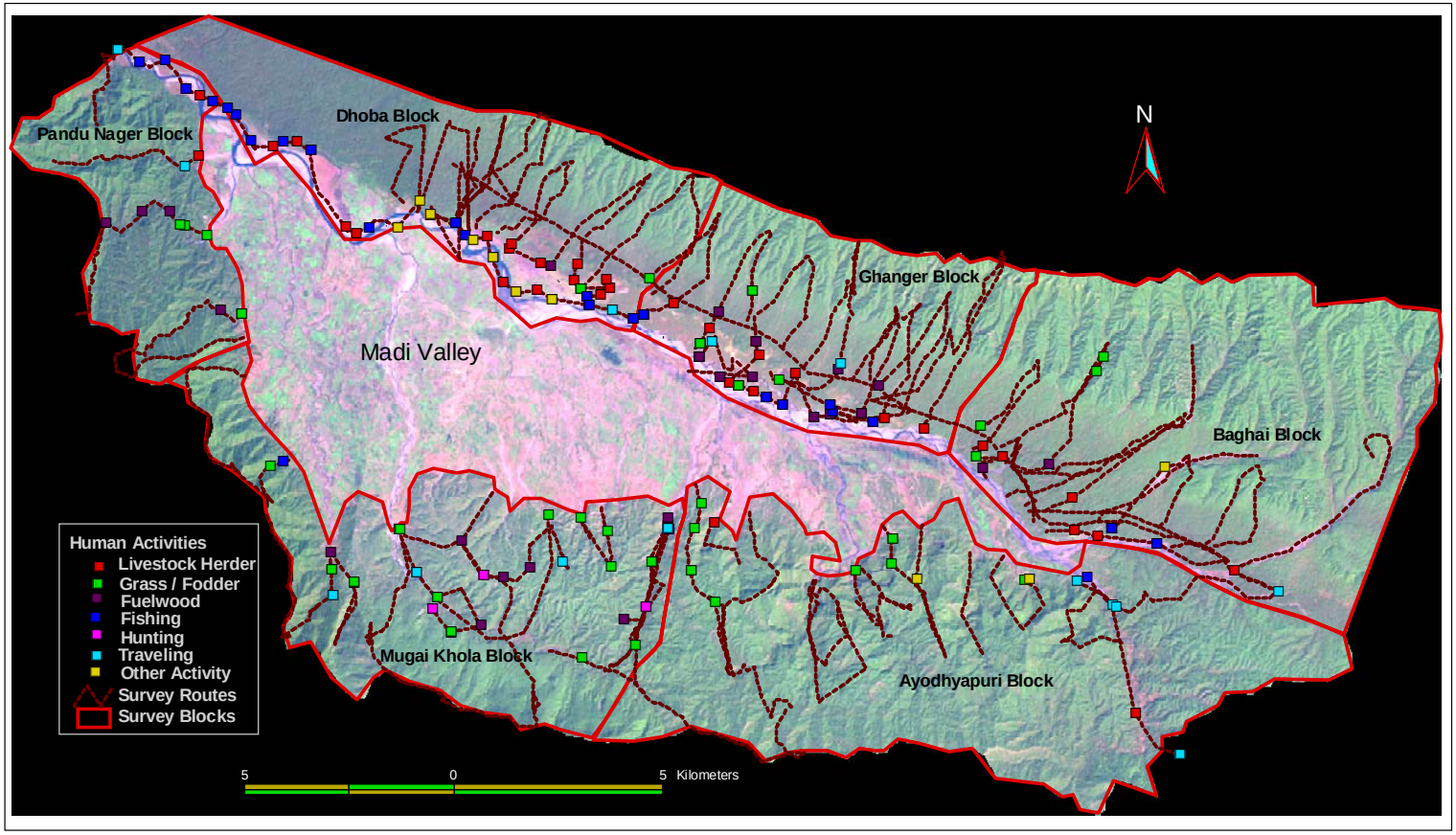


Figure 20. Human resource use in Madi Valley

Human Attitudes towards Tigers

A total of 400 hh were interviewed to understand the perceptions of Madi population towards tigers (Figure 21). The total population of Madi Valley watershed is 39,314 with 48% male and 52% females living in 7,719 households. The majority of the households are of hill immigrants belonging to many different ethnic groups, but majority are Brahmin / Chhetri group (37%) (Table 8). The long time residents / Tharu ethnic group constitutes 23% of the Madi population.

Respondents were male 54% and female 46% (Table 9). Respondent aged 15 years and above were interviewed. Forty two percent of the respondents were uneducated, 34% had primary, and 20% had secondary level education (Table 10). Majority of the sample (69%) were experienced working age group (30 to 59) (Table 11).

Local people perception is crucial in the management and protection of tigers especially where human tiger conflicts are increasing. We investigated the local people's liking and disliking of tigers. The reason for liking was categorized into discrete values of tiger as discussed by Kellert (1985). Approximately half of the (52%) respondents have seen the tiger in the forest (Table 12). The majority of the respondents did not like tigers living in the neighboring forest nor in the community forest (Table 13a and 14a). In general the reason for not liking tigers living in those forests was threat to people getting killed (Table 13c) and livestock depredation. Similarly, majority of the respondents did not like tigers in the buffer zone community forests because they feel threatened of tigers while extracting resource (Table 14c). With regards to liking tiger's majority of the respondents perceive tiger has ecological, moral and utilitarian values (Table 13b and 14b).

Long term protection of tiger is a biggest concern for park management and tiger conservationists alike. When asked about where the tigers should be protected nearly half of the respondents (47%) had the opinion that protecting of tigers should only in the national park (Table 15). However, just over a quarter (27%) of the respondents had supported protecting tiger everywhere they are currently found and 17% even felt that tigers should be protected in areas where they expand their distribution.

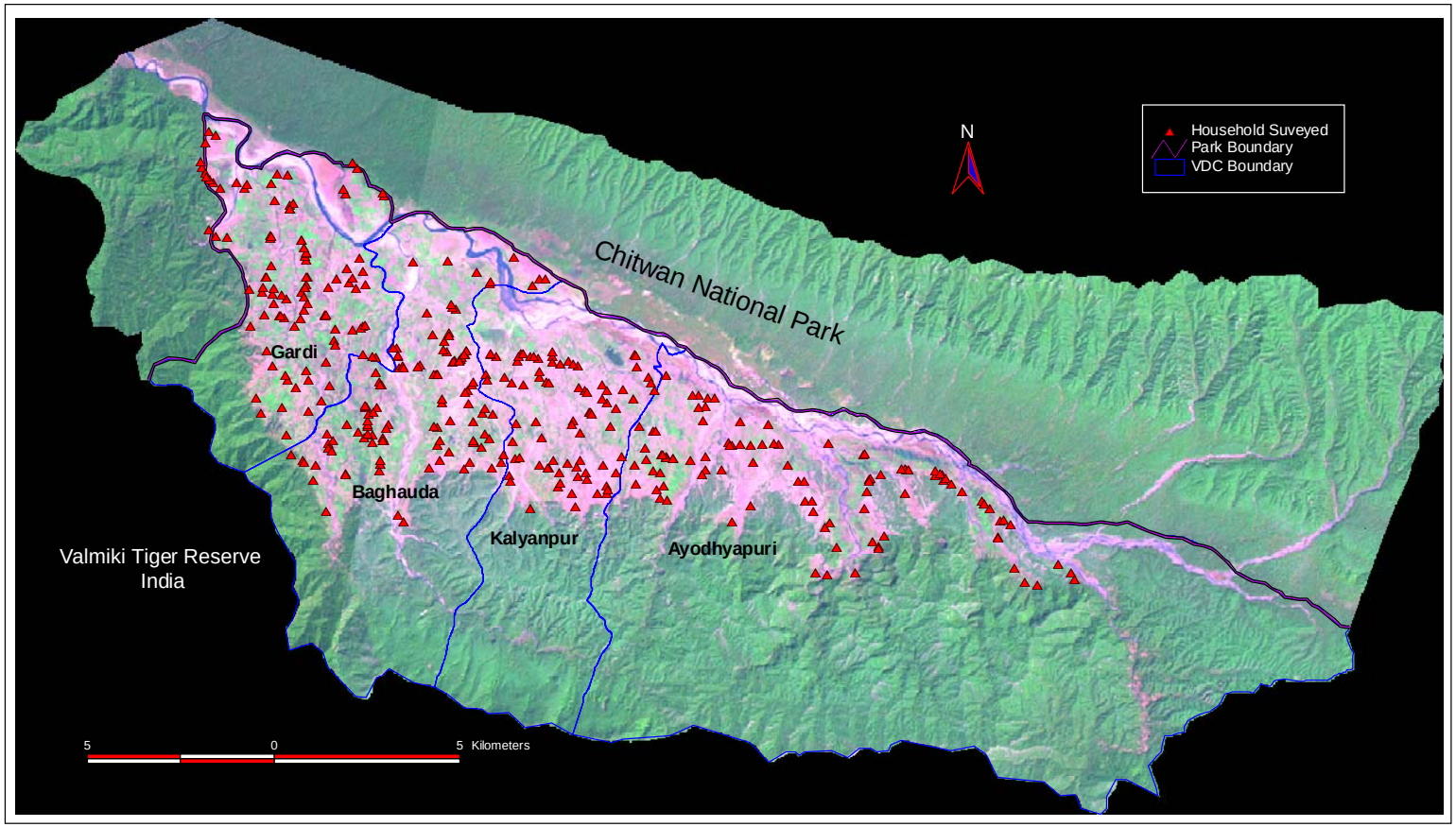


Figure 21. Locations of 400 hh sampled from four VDCs in Madi Valley.

DISCUSSIONS

Intensity of tiger human conflicts

The intensity of tiger and human conflicts in and around CNP has significantly increased over the years. Increasing number of human death due to man-eating tigers certainly possesses a serious concern to the local people and similar trend of losing problem tigers indicates a serious threat to tiger survival. This conflict of human and tigers potentially hinders the goal of TAL to increase the land base for tigers and to re-establish tiger dispersal corridors between reserves.

This research indicated two important issues that may help achieve the goal of TAL. The first encouraging issue is that tigers are using the buffer zone habitat more frequently and are establishing breeding territories in community forests due to the restoration of these forests. Tigers are not only settling in the buffer zone but are also dispersing beyond into the national forests suggesting the possibilities for tigers to disperse through the re-established corridor habitats. The second conflicting issue is that once tigers settle in the buffer zone confrontations with humans harvesting resources increases significantly. Encouraging local Community Forestry User Committees to employ “Bagh Heralu” to monitor tigers will help inform local people about activities that increase risks of tiger human conflicts.

The distribution map of human killed and problem tigers removed show that tigers are using the buffer zone and dispersing into the national forests. This is most likely due to the improved condition of the buffer zone forests through community- based restoration programs. In early 1970s through the early 1990s, forests adjoining the park were degraded and was not much used by the tigers (McDougal and Smith personal

communication); however, since the implementation of the buffer zone management regulation of 1993, when buffer zone forests were handed over to the buffer zone user committees forest protection increased natural prey creating additional tiger habitat. Community-based management activities in recent years include controlling livestock grazing and timber harvests, establishing tree plantations in severely degraded areas, and allowing natural regeneration in low degraded forest habitats. Due to such efforts the forests once degraded have regenerated, restored prey and increased tiger habitat. This trend is important for long term tiger viability in the terai and should not be reversed. It will take creative programs and local involvement to reduce human tiger conflict.

Many of the tigers in the unprotected forests in the terai region are killed in retaliation to tigers killing livestock (Gurung 2002). Similar trend is observed in the buffer zone of the CNP where every man-eating tigers are killed, poisoned or removed from the area. Three man-eating tigers were killed in three consecutive days in the year 2004. If tigers are killed at such rate dispersal through out re-established corridor habitat between reserves is likely to be unsuccessful. Mitigating the conflict between tiger and human could provide opportunity for tiger to disperse from one reserve to another. Even a single successful dispersal of tiger in one generation from one population to another could contribute significantly to the population viability the ultimate goal of TAL.

Man-eating tiger's behavior

Human beings are not a part of the tiger's natural prey because tiger evolved to prey on large ungulates. The upright, bipedal human is in stark contrast to the quadruped form of natural prey (McDougal 1987). However, tigers do kill people accidentally or deliberately. Man eating tigers can be defined as "problem tigers" that deliberately kill

people for food. Hunger is usually the reason that tigers kill humans.

In Chitwan we identified factors associated with man-eating behavior: (1) injured or aged individuals find it difficult to kill natural prey, (2) there is an abundance of domestic livestock and reduced natural prey in national forests, (3) aggressive behavior, and (4) defensive or accidental killing.

Aged and injured tigers are often incapable of killing natural prey. Furthermore, due to their condition they are forced out of territories in prime habitat to the marginal areas by younger healthy animals. Inability to hunt down natural prey and low density of natural prey in the marginal habitat were the most frequent factors associated with man-eating behavior. Out of the 17 man-eating tigers that were investigated, nine were in poor condition (e.g. worn canines and broken claws or other injuries from fights with other tigers or gun shot wounds) making them incapable of hunting natural prey. A typical example was an old male with worn out teeth and broken claws who killed two people who were sleeping on the verandah of their homes. During the early and mid years of 20th century most of the man-eating tigers that Jim Corbett (2005) and Arjun Singh (1993) killed had injuries. However, not all aged tiger kill people; it is primarily old tigers that are driven into the marginal or multiple use forests that turn into man-eaters.

Tigers living in a sub-optimal habitat with low density of natural prey, injured animals or those with aggressive nature turned into “desperate man-eaters”. However, in some cases, tigers kill humans as a result of defensive behavior or are simply accidental killing. Bhimle Pothi is an example of a tiger killing by accidental; she killed a woman inside the park in 2003 but did not eat the victim and has not killed since. Generally, a tiger who kills a person as an accidental response to sudden encounter should not be

consider man-eater. For example a tigress with small cubs may attack and kill a person who unintentionally gets too close. In three cases, tigresses almost certainly killed people because the female felt that her cubs were threatened. This was the case when Tamor Pothi killed her first victim inside the park in February 1999; no action was taken at that time. Later in 2002 she was captured and released in another area because she went outside the park and killed domestic livestock and was deemed to be a threat. In the new released area she killed her second victim and was then considered a man-eater. The second case is Ujeli Pothi. She had cubs < 6 months old with her when she killed a man. No action was taken against her. The third case is Bhagedi Pothi who had three cubs ~ 9 months old with her when she killed three people in 20 minutes. She did not eat any of the five people she killed indicating that sub-optimal habitat or hunger was not a factor leading her to kill. Nearly one fourth of the victims killed in Chitwan were not eaten. In many cases tigers did not have the opportunity to eat the kill due to human interference.

When should a tiger be labeled man-eater? Obviously a serial killer is a man-eater but a tiger that kills only one person is often not considered to be man-eater, even if the victim has been eaten. Of the 37 tigers that killed people, 18 killed only once and of those, 6 were eliminated due to the fear that it would kill again. For example Baghmara Pothi (old and impaired) and Syaulibas Pothi (injured) entered houses to kill their victims. In contrast, Bachcha Bhale, a young healthy male tiger living in an optimal habitat showed unusually aggressive behavior and was removed from the area.

More than half the people killed in CNP were grass cutters or fodder collectors. Grass cutting requires people to sit or bend down. A person in such a posture in a dense environment may resemble natural prey. Seidensticker and McDougal (1991) observed

tigers often kill peoples sitting or bending over. Furthermore, fodder collection requires people to enter thick bushes where succulent foods preferred by livestock are located. Entering such areas has higher risk of encountering tigers resting during the day. Most of the victims killed during the midday were in dense vegetation. Taking precautions before entering such areas could avoid the accidental killing.

When tigers kill people in the buffer zone, the park authorities take immediate action. If tiger kills people inside the park action against the tiger is not taken because people are trespassing. However, if the tiger is a deliberate man-eater, park authorities take action (e.g. executions, capture / release, or detain in captivity). Although action may be urgent, difficult terrain and identification of man-eater hampers efforts to eliminating them from the area. For example, elimination of two males in the Daunne and Someshwor Hills took several days.

Identification of true man-eater in a high tiger density area such as grassland and riverine habitats inside the park also demands more expertise. In 80's most of the people were killed inside the park and many man-eating tigers were disposed from the area. Field biologists and technicians from Tiger Ecology Project and ITNC have been assisting the park authorities in identification and removal of the problem tigers. A long term tiger monitoring program not only assists determining the status of individual tigers but also helps in identification and removal of man-eaters. A tiger monitoring program may be used in mitigating tiger human conflict by monitoring the daily movement pattern of tiger in the buffer zone. Information of tiger movement in an area can be shared with local villagers alerting them to avoid using high risk areas.

Tiger and Prey Abundance in Madi Valley

Madi Valley was selected to investigate the tiger behavior and prey abundance in buffer zone forests due to the high human fatalities in the area (McDougal 2005). Our goal was to understand the patterns of human activity, the ratio of abundance of domestic and wild tiger prey, and the distribution and behavior of tigers so that local communities can devise plans to better co-exist with tigers.

The recce surveys indicate that tiger and leopard are widely distributed in both the park and the buffer zone. However, overall tiger abundance is relatively higher in the park than the buffer zone despite of some blocks inside the park that showed low tiger signs. The lowest encounter rate of tiger is observed at Dhoba block inside the park could be explained due to relatively high human and livestock use in this forest block. In contrast highest encounter rate of leopard is observed at Pandunagar block due to the presence of cubs with female provided more track sets. The encounter rate comparison of tiger track set is a good measure between the park and buffer zone because habitat type and physical features are similar.

With regards to ungulate species in Madi valley, buffer zone has relatively low prey abundance than the park. The lowest prey abundance measured as sambar unit was observed in Mugai khola block in the buffer zone presumably due to the high human use and hunting pressure. Fourteen hunters hunting deer with large nets were encountered during the survey in this block. Nevertheless, forest blocks in the buffer zone other than Mugai have good sambar deer abundance. Nearly fifty percent of the pellet composition in the buffer zone was sambar. Canyon with dense vegetation provides good foraging habitats for sambar and high ridge tops and its slope with grass supports basking and

resting area in winter. In contrast forest blocks inside the park offer a hilly terrain in the Churia range and grazing lawn along the Reu River supporting both sambar in the hills and chital in the low Sal forests and meadows. Chittal and sambar pellet composition are relatively high.

The villagers that venture into the forests to graze livestock and collect forest products inevitably come into conflict with tigers. The extent of livestock grazing and human use of forest resources were measured as encountered rate of livestock and human during the recce survey. There was a strong contrast in livestock grazing in the park and buffer zone. The encounter rate of livestock was significantly high inside the park than buffer zone. The livestock grazing is not allowed either inside the park or in the buffer zone community forests. However, the livestock grazing has been very well controlled inside the buffer zone by the community-based management. The local user groups strictly follow and monitor the set rules. When the livestock are apprehended by the forest guards in the community forests the owners are fined. Such rules also exists for the park, however, the lack of guard post due to insurgency, and open access along the Reu River, livestock grazing has become uncontrolled inside the park. The livestock grazing is significantly higher all along the Reu River up to 2 km inside the park to the fire line. This area has several grazing lawn or meadows where hundreds of livestock are grazed.

Parallel to livestock relatively high number of human was encountered inside the park than the buffer zone as many accompanied their livestock as herder. Similarly, high number of human uses buffer zone community forests for fuel-wood, fodder and extraction of other forest products. Ayodhyapuri block in the buffer zone forest reported lowest human encounter rate because people in that area were still scared to go into the

forest where tiger had killed 5 people in March, 2004.

Human Attitudes toward Tigers

Support of local people is critical to tiger conservation in the human dominated landscape, especially in areas where conflict between the two is significantly high. People's attitude towards tiger can be determined by few important but simple questionnaire surveys. One such question we asked was: do you like tiger living in the neighboring or community forests? Majority of the people in Madi valley did not like tiger in the neighboring or community forests because of danger of getting killed and livestock depredation. Many people were also threatened of tigers would come to village and harm them. Such perception of tigers coming to the village and kill people could have been due to the fact that few man-eating tigers came to the house in the villages and killed people. One such case was in Syaulibas where a woman was killed at home in 1999. Similarly, few people were also killed at close proximity of the houses. Furthermore, few man-eating tigers were removed from the forests nearby the villages where people observed and also took part in the man-eating tiger removal operations. Experiencing such events may have impacted their perception of tiger coming to the village and endangered human and livestock lives. Moreover, livestock depredation by leopards at stockade at homes is more frequent than tigers. Such incidents could also seem to have attributed to negative perceptions towards tiger.

On the other hand however, just less than half of the people in Madi valley liked tigers living in the buffer zone or in the neighboring forest. The various reasons for liking tigers were classified into seven categories of valuing endangered species described by Kellert (1985). Most of the people liked tigers because of the ecological value in which

they inter-related tigers to the maintenance of forests. People perceived presence of tigers help forest stay intact. Utilitarian and moral values were also expressed by many of the respondents for liking tigers. Utilitarian value is expressed for tigers to attract wildlife tourism because it is one of the main attraction and charismatic animal in CNP. Moral values are also expressed as inherent rights to exist. Few people in the Madi valley also like tigers due to the naturalistic, aesthetic and cultural value.

The problem of man-eating tigers need to be dealt seriously because people perceived tiger as a threat to their lives in the Madi valley and has the potential to erode support for tiger conservation. The current management of immediate action against man-eating tigers in the buffer zone to eliminate the culprit has been effective. However, such action may solve the immediate man-eating problem but victim's families may not have a supportive attitude towards tiger due to the loss. Likewise, elimination of man-eating tigers or tigers risking human lives in the buffer zone reduces the overall tiger population size and the potential for tiger dispersal. To mitigate the conflict between tigers and humans, we recommend the following:

RECOMMENDATIONS

1. Establish Local Forest Guard as "Bagh Heralu"

The problem of human tiger conflict is directly related to people living around the park; therefore mitigation of this problem should be discussed jointly between the park management and local people. One of the ways could be to get the local people involved in tiger and prey monitoring activities by establishing the local people as "Bagh Heralu" to monitor tiger in their respective areas. Currently, the buffer zone user committee and community forestry user group employs a forest

guard, to check illegal grazing and human activities in their buffer zone community forests. These forest guards can be trained to monitor tigers, leopard, and ungulates in addition to their current job. Monitoring tigers in their community forest on a daily basis can help to understand the activity pattern of tigers. Based on the activity pattern of the tiger's movement, people can be alerted when harvesting resources in the buffer zone in order to minimize confrontation with tigers.

2. Monitor Tigers on a Regular Basis

Our simple method of surveying tiger, leopard and human pressure to evaluate their status in the buffer zone and park can be easily repeated. We suggest conducting the monitoring activities jointly with the park staff, "Bagh Heralu" and wildlife technicians from different NGOs specialized in wildlife monitoring.

3. Enhance Tiger Research in Sub-optimal Habitats

More than half of the problem tigers removed was in the marginal or sub-optimal tiger habitats. Impaired tigers turning into man-eater due to old age or injury are easier to understand. It is important to study tigers living in the buffer zone of the park. This can best be accomplished by having park rangers and local "Bagh Heralu" team up on tiger behavioral research based on radio collaring animals living in the buffer zone of CNP. These research teams could document the extent to which tigers in the buffer zone depend on domestic prey, explore ways to reduce tiger and human interactions.

4. Create Problem Tiger Response Team

During our research local people requested that a problem tiger response team be created. We did respond to some problem tiger situations to explore how to reduce conflict. For example, on the 6th June 2006, a goat was completely eaten by the house and tiger track was reported at Sheruwa village in Meghauly VDC. Chairman of the Buffer zone council resident of Meghauly VDC asked our team working at Madi Valley to investigate the site where the goat was killed. We visited the site and confirmed that the kill was made by a tiger and we were able to identify the animal as a tigress, Bhimle Pothi, who was identified by her unique pugmarks. We instructed the forest guards and the members of the community forestry user group to inform villagers to stay alert at night, but we realized that radio collaring animals is the only way to monitoring tigers on a regular basis. Response teams should be headed by the park authorities and include, park staff, a wildlife technicians from NTNC, ITNC, and local "Bagh Heralu".

5. Tiger Conservation Awareness Program

Majority of the people in Madi valley did not like tigers living in the neighboring or community forests. Such perception is an indication of negative support for tiger conservation. We believe negative attitude of people could be due to not having the understanding of tiger biology and behavior. Therefore tiger conservation awareness program should be implemented to educate the local people on tiger behavior, biology, its need, importance, status in the park and buffer zone community forest. Additional discussion on how to mitigate man-eating problem should be discussed.

6. **Establish Tran boundary Co-operation between Valmiki Tiger Reserve and Chitwan National Park**

There has been a several high level meetings conducted on the trans-boundary co-operation between India and Nepal on tiger related issues. The Chitwan NP and Valmiki TR offers unique possibilities for trans-boundary co-operation as it shares a long international border between the two reserves. The tiger monitoring should be conducted jointly by the Indian and Nepalese wildlife technicians along the border areas.

7. Allocation of Livestock Grazing Areas

It is interesting to learn that the community-based management has totally controlled the grazing of livestock in the community forests in Madi Valley. However, livestock grazing pressure has shifted from community forest to the park as demonstrated by our study. There are no areas set aside for livestock grazing. Grazing areas should be recognized along most of the river system or some part of buffer zone forests in the Madi valley.

LITERATURE CITED

Ahearn, S.C., J.L.D. Smith, C. Wee. 1990. Framework for a geographically referenced tabular/visual conservation database: case study Nepal. Photogrammetric Engineering and Remote Sensing 56:1477-1481.

Ahearn, S.C., J.L.D. Smith, A.R.Joshi and J.Ding. 2001. TIGMOD: an individual-based spatially explicit model for simulating tiger/human interaction in multiple use forests. Ecological Modeling 140: 81-97.

Ahearn, S.C. and J.L.D.Smith. 2005. Modeling the interaction between humans and animals in multiple-use forests: a case study of Panthera tigris. Pages 358-387 in D. Maguire, M. Batty and M. Goodchild (eds.). GIS, Spatial Analysis, Modeling. ESRI Press, Redlands, California, USA.

Barlow, A. 2004. Monitoring wild tiger (*Panthera tigris*) populations: lessons from a long-term camera trapping study in Royal Chitwan National Park, Nepal. MS thesis, University of Minnesota, St. Paul, MN, USA.

Corbett, J. 2005. The Jim Corbett Omnibus. Oxford University Press, New Delhi.

Dhakal, N. 2006. Assessment of resident well-being and perceived biodiversity impacts in the Padampur resettlement, Royal Chitwan National Park, Nepal. MS thesis, University of Minnesota, St. Paul, MN, USA.

Dinerstein, E., E. Wikramanayake, J. Robinson, U. Karanth, A. Rabinowitz, D. Olson, T. Mathew, P. Hedao, M. Connor, G. Hemley, and D. Bolze. 1997. A framework for Identifying High Priority Areas and Actions for the Conservation of Tigers in the Wild. Part 1. Washington DC, World Wildlife Fund-US and Wildlife Conservation Society.

Dinerstein, E., A. Rijal, M. Bookbinder, B. Kattel, and A. Rajuria. 1999. Tigers as neighbors: efforts to promote local guardianship of endangered species in lowland Nepal. Pages 316-332 in J. Seidensticker, S. Christie and P. Jackson, editors. Riding the tiger: Tiger conservation in human-dominated landscapes. Cambridge University Press, Cambridge, United Kingdom.

DNPWC. 1999. Tiger conservation action plan for the Kingdom of Nepal. WWF Nepal Program, Kathmandu.

DNPWC/MFSC. 1999. Buffer Zone Management Regulation, 1996 and Buffer Zone Management Guidelines, 1999. Department of National Parks and Wildlife Conservation, Babar Mahal, Kathmandu.

DNPWC and PPP. 2000. Royal Chitwan National Park and Buffer zone, Resource Profile. Babar Mahal, Kathmandu.

Dhungel, S.K. 1985. Ecology of the hog deer in Royal Chitwan National Park, Nepal. Ph.D. thesis, University of Montana, USA.

Gurung, B., J.L.D. Smith and M. Shrestha. 2006. Using "Bagh Heralu" network to map the metapopulation structure of tigers in Nepal, in J. McNeely, T. McCarthy, A. Smith, L. Whittaker and E. Wikramanayake, editors. Conservation Biology in Asia. Kathmandu, Nepal.

Gurung, B.B. 2002. Mapping the meta-population structure of tigers throughout Nepal by establishing a tiger monitoring network of "Village Rangers". MS thesis, University of Minnesota, St. Paul, MN, USA.

Gurung, K.K. 1983. Heart of the Jungle. Andre Deutsch, London.

Hemley, G. and J. Mills. 1999. The beginning of the end of tigers in trade? Pages 217-229 in J. Seidensticker, S. Christie and P. Jackson, editors. Riding the tiger: Tiger conservation in human-dominated landscapes. Cambridge University Press, Cambridge, United Kingdom.

HMGN/MFSC, 2004. Terai Arc Landscape-Nepal Strategic Plan (2004-2014), Broad Strategy Document. Ministry of Forest and Soil Conservation, Planning and Human Resource Development Division. Kathmandu, Nepal.

Jackson, P. 1997. The status of the tiger in 1997 and threats to its future. Cat News 27: 8-10.

Kellert, S.R. 1985. Social and perceptual factors in endangered species management. Journal of Wildlife Management 49(2): 528-536.

Kenney, J. S., J. L .D. Smith, A. M. Starfield, and C. McDougal. 1995. The long-term effects of tiger poaching on population viability. Conservation Biology 9: 1127-1133.

Luo, S.J., J.H. Kim, W.E. Johnson, J. van der Walt, J. Martenson, N. Yuhki, D.G. Miquelle, O.Uphyrkina, J.M.Goodrich, H.B.Quigley, R.Tilson, G.Brady, P.Martelli, V.Subramaniam, C.McDougal, S.Hean, S.Huang, W.Pan, U.K.Karanth, M. Sunquist, J.L.D.Smith and S.J.O'Brien. 2004. Phyloeography and genetic ancestry of tigers (*Panthera tigris*). PLOS Biology 2(12):2275-2293.

McDougal, C. 1977. The face of the tiger. Rivington Books, Andre Deutsch, London.

McDougal, C. 1987. The Man-eating tiger in geographical and historical perspective. Pages 435-448 in R. L. Tilson and U. S. Seal, editors. Tigers of the World: The Biology, Biopolitics, Management and Conservation of an Endangered Species. Park Ridge, New Jersey, Noyes Publications.

McDougal, C. 1999. You can tell some tigers by their tracks with confidence. Page 190 in J. Seidensticker, S. Christie and P. Jackson, editors. Riding the tiger: Tiger conservation in human-dominated landscapes. Cambridge University Press, Cambridge, United Kingdom.

McDougal, C., A. Barlow, D. Thapa, S. Kumal and D. B.Tamang. 2005. Tiger and Human Conflict Increase in Chitwan Reserve Buffer Zone, Nepal. Cat News 40: 3-4.

McDougal, C. 2005. Preliminary report of tiger presence in the Buffer Zone of Royal Chitwan National Park (RCNP). Report submitted to Department of National Park and Wildlife Conservation. Babar Mahal, Kathmandu. Nepal.

Mills, J.A. and P. Jackson. 1994. Killed for a cure: A review of the world-wide trade in tiger bone. Cambridge, TRAFFIC International.

Mishra, H.R. 1982. The ecology and behavior of chital (*Axis axis*) in the Royal Chitwan National Park, Nepal. Ph.D. thesis, University of Edinburgh, UK.

Pradhan, A. S. and P. J. Parks. 1995. Environmental and socioeconomic linkages of deforestation and forest land use change in the Nepal Himalaya. Pages 167-179 in S. Hanna and M. Munasinghe, editors. Property rights in a social and ecological context. The World Bank, Washington D.C., USA.

RCNP, 2004. Royal Chitwan National Park and Buffer zone, Annual Report 2004. Sulabh Printing Press, Narayanghat, Chitwan.

Seidensticker, J. 1976. On the ecological separation between tigers and leopards. Biotropica 8: 225-234.

Seidensticker, J. and C. McDougal. 1993. Tiger predatory behavior, ecology and conservation. Symposia of the Zoological Society of London 65: 105-125.

Shrestha, M. 2004. Relative Ungulate Abundance in a Fragmented Landscape: Implications for Tiger Conservation. Ph.D. thesis, University of Minnesota, St. Paul, MN, USA.

Singh, A. 1993. The Legend of the Man-eater. Ravi Dayal Publisher, New Delhi.

Smith, J.L.D., M.E.Sunquist, K.M.Tamang and P.B.Rai. 1983. A technique for capturing and immobilizing tigers. Journal of Wildlife Management 47: 255-259.

Smith, J.L.D. 1984. Dispersal communication and conservation strategies for the tiger (*Panthera tigris*) in Royal Chitwan National Park, Nepal. Ph.D. thesis. University of Minnesota, MN, USA.

Smith, J. L. D., C. McDougal and M. E. Sunquist. 1987. Female land tenure systems in tigers. Pages 97-109 in R. L. Tilson and U. S. Seal, editors. Tigers of the World: The Biology, Biopolitics, Management and Conservation of an Endangered Species. Park Ridge, New Jersey, Noyes Publications.

Smith, J.L.D., C. McDougal and D. Miquelle. 1989. Scent marking in free-ranging tigers Panthera tigris. Animal Behavior 37: 1-10.

Smith, J.L.D. and C. McDougal. 1991. The contribution of variance in lifetime reproduction to effective population size in tigers. Conservation Biology 5: 484-490.

Smith, J. L. D. 1993. The role of dispersal in structuring the Chitwan tiger population. Behavior 124: 165-95.

Smith, J.L.D, S.C. Ahearn and C. McDougal. 1998. Landscape analysis of tiger distribution and habitat quality in Nepal. Conservation Biology 12 (6): 1338-1346.

Smith, J. L. D., C. McDougal, S. C. Ahearn, A. Joshi and K. Conforti. 1999. Metapopulation structure of tigers in Nepal. Pages 176-189 in J. Seidensticker, S. Christie and P. Jackson, editors. Riding the tiger: Tiger conservation in human-dominated landscapes. Cambridge University Press, Cambridge, United Kingdom.

Smythies, E. A. 1942. Big Game Shooting in Nepal. Thacker, Spink and Co., Calcutta.

Sunquist, M. E. 1979. The movements and activities of tigers (*Panthera tigris tigris*) in Royal Chitwan National Park, Nepal. PhD. Thesis. University of Minnesota, St. Paul, MN, USA.

Sunquist, M. 1981. The social organization of tigers (*Panthera tigris*) in Royal Chitwan National Park, Nepal. Smithsonian Contributions to Zoology, 336: 1-98.

Sunquist, F. and M. Sunquist. 1988. Tiger Moon. Chicago, University of Chicago Press.

Tamang, K.M. 1982. The Status of the tiger (*Panthera tigris*) and its impact on principal prey populations in Royal Chitwan National Park, Nepal. East Lansing, Michigan State University, PhD Dissertation. MI, USA.

Wikramanayake, E.D., E. Dinerstein, G. Robinson, K.U. Karanth, A.R.Rabinowitz, D. Olson, T. Matthew, P. Hedao, M.Connor, G. Hemley and D. Bolze. 1998. An ecology-based method of defining priorities for large mammal conservation: the tiger as case study. Conservation Biology 12: 865-878.

Wikramanayake, E., M. McKnight, E. Dinerstein, A.R.Joshi, B. Gurung and D. Smith. 2004. Designing a conservation landscape for tigers in human-dominated environments. Conservation Biology 18 (3):839-844.

WWF. 2001. Terai arc landscape, Nepal. WWF Nepal Program, Kathmandu.

Tables

I. Socio-demographic characteristics

Table 1: Total and sample population of 4 VDC of Madi Valley, Chitwan

	Total Population			Sample Population		
VDC	Total hh	Total pop	%	Total hh	Total Pop	%
Ayodhyapuri	1921	9774	0.25	100	509	0.25
Kalyanpur	1573	7543	0.20	80	384	0.19
Baghauda	2208	11544	0.29	116	606	0.29
Gardi	2017	10453	0.26	104	539	0.27
Total	**7,719**	**39,314**	**100**	**400**	**2038**	**100**

Table 2: Total and sample population of 4 VDCs by ward numbers in Madi Valley.

		Total Population			Sample Population		
VDC	Ward No.	Total hh	Total Pop	%	Total hh	Total Pop	%
1.Ayodhyapuri	1	187	842	10	8	36	8
	2	245	1172	13	14	67	14
	3	151	744	8	8	39	8
	4	38	185	2	2	10	2
	5	138	726	7	9	47	9
	6	367	1897	19	17	88	17
	7	250	1328	13	17	90	17
	8	159	866	8	9	49	9
	9	386	2014	20	16	83	16
Total		**1,921**	**9,774**	**100**	**100**	**509**	**100**
2. Kalyanpur	1	110	552	7	3	17	4
	2	213	1066	14	11	55	14
	3	142	742	9	9	47	11
	4	287	1421	18	14	69	18
	5	268	1209	17	12	54	15
	6	157	729	10	8	37	10
	7	187	812	12	13	56	16
	8	88	434	6	2	11	3
	9	121	578	8	8	38	10
Total		**1,573**	**7,543**	**100**	**80**	**384**	**100**
3. Baghauda	1	293	1515	13	15	78	13
	2	272	1489	12	9	49	8
	3	282	1422	13	16	81	14
	4	231	1213	10	14	74	12
	5	97	511	4	4	21	3
	6	202	1202	9	10	60	9
	7	136	727	6	12	64	10
	8	278	1288	13	16	74	14
	9	417	2177	19	20	105	17
Total		**2,208**	**11,544**	**100**	**116**	**606**	**100**

4. Gardi	1	211	1088	10	13	67	13
	2	334	1756	17	18	95	17
	3	269	1306	13	13	63	13
	4	160	904	8	6	34	6
	5	176	945	9	7	38	7
	6	148	705	7	10	48	10
	7	160	873	8	8	44	8
	8	405	2076	20	16	82	15
	9	154	800	8	13	68	13
Total		**2,017**	**10,453**	**100**	**104**	**539**	**100**
Grand Total		**7,719**	**39,314**		**400**	**2,038**	**100**

Table 8: Ethnicity of respondents and total population of Madi

Ethnicity	Sample	%	Total	%
Brahmin & Chhetri	170	43	15497	37
Tharu	84	21	9714	23
Others	146	36	16133	39
Total	**400**	**100**	**41344**	**100**

Table 9: Respondents gender categories

Gender	n	%
Male	218	54
Female	182	46
Total	**400**	**100**

Table 10: Respondents education level

Level	n	%	Valid %
Uneducated	162	41	42
Primary	129	32	34
Secondary	76	19	20
Higher Secondary	13	3	3
College	5	1	1
Total	**385**	**96**	**100**
Missing	**15**	**4**	
Total	**400**	**100**	

Table 11: Age categories of respondents

Age	n	%
15-29	69	17
30-59	276	69
60-100	55	14
Total	**400**	**100**

II. Attitudes

Table 12: Respondents tiger sighting

Have you seen tiger in the forest?		
Response	**n**	**%**
Yes	207	52
No	168	42
Did not answer	25	6
Total	**400**	**100**

Table 13a: Respondents attitudes towards tiger

Do you like tiger living in the neighboring forests?		
Response	**n**	**%**
Yes	163	41
No	234	58
Did not answer	3	1
Total	**400**	**100**

Table 13b: Respondents reasons for liking tiger in the neighboring forests

Reasons	n	%	Valid %
Naturalistic / Outdoor recreational value (beauty, entertainment)	5	3	3
Ecological value (intact forests, increases forest charm)	45	28	29
Moral / Existence value (right to live in the forest)	30	18	19
Aesthetic value (endangered / protected species)	13	8	8
Utilitarian value (tourism)	30	18	19
Cultural / Religious value (King of the jungle, symbol of god)	21	13	13
I like tiger if no harm is done	14	9	9
Total	**158**	**97**	**100**
Missing	**5**	**3**	
Total	**163**	**100**	

Table 13c: Respondents reason for not liking tiger in the neighboring forests

Reasons	n	%
Threat to people and livestock	68	29
Threat to people getting killed	98	42
Threat to livestock killing	20	8
Threat of tiger coming to village	16	7
Threat to people using the forest	27	12
I do not like tiger because it should be in the national park	5	2
Total	**234**	**100**

Table 14a: Respondents attitudes towards tiger

Do you like tiger living in the buffer zone community forests		
Response	**n**	**%**
Yes	177	44
No	220	55
Did not answer	3	1
Total	**400**	**100**

Table 14b: Respondents reasons for liking tiger in the community forests

Reasons	n	%	Valid %
Naturalistic / Outdoor recreational value (beauty, entertainment)	2	1	1
Ecological value (intact forests, increases forest charm)	62	35	37
Moral / Existence value (right to live in the forest)	26	15	15
Aesthetic value (endangered / protected species)	7	4	4
Utilitarian value (tourism)	49	28	29
Cultural / Religious value (King of the jungle, symbol of god)	12	7	7
I like tiger if no harm is done	11	6	7
Total	**169**	**96**	**100**
Missing	**8**	**4**	
Total	**177**	**100**	

Table 14c: Respondents reason for not liking tiger in the community forests

Reasons	n	%	Valid %
Threat to people and livestock	33	15	15
Threat to people getting killed	27	12	12
Threat to livestock killing	7	3	3
Threat of tiger coming to village	13	6	6
Threat to people while using the forests using the forest	135	61	62
I do not like tiger because it should be in the national park	4	2	2
Total	**219**	**99**	**100**
Missing	**1**	**1**	
Total	**220**	**100**	

Table 15: Respondents opinion about tiger protection

Opinion	n	%
Tiger should not be protected	8	2
Tiger only be protected in national park and reserve	189	47
Tiger be protected everywhere currently found	106	27
Tiger be protected even beyond its current distribution	69	17
Did not answer	28	7
Total	**400**	**100**

Appendix: Survey Questionnaires for the Assessment of Human Attitudes Towards Tigers

Name of interviewer: …… Date: ……..

District: …… VDC: …… Ward No: ……..

Village: ……..……

GPS Location: UTM X: ……..UTM Y: …… Altitude: ……

Name of interviewee: …….. Age: ……Sex: ……..

Education: ……

Occupation: Crop farmer/ Livestock farmer / Mixed farmer / Business / Other:

Ethnicity: ……

Attitude

1. Have you seen a tiger in the forest?
2. Do you like tigers living in your neighboring forests? Yes or No?

   If yes why, if no why not……
3. In your opinion tigers in Nepal should: (Circle one): 1. not be protected 2. Only be protected in protected areas 3. Be protected everywhere currently found 4. Be protected even beyond its current distribution.
4. Do you like tigers living in the buffer zone community forests? Yes or No?

   If yes why, if no why not……